Department of Health
and the Welsh Office

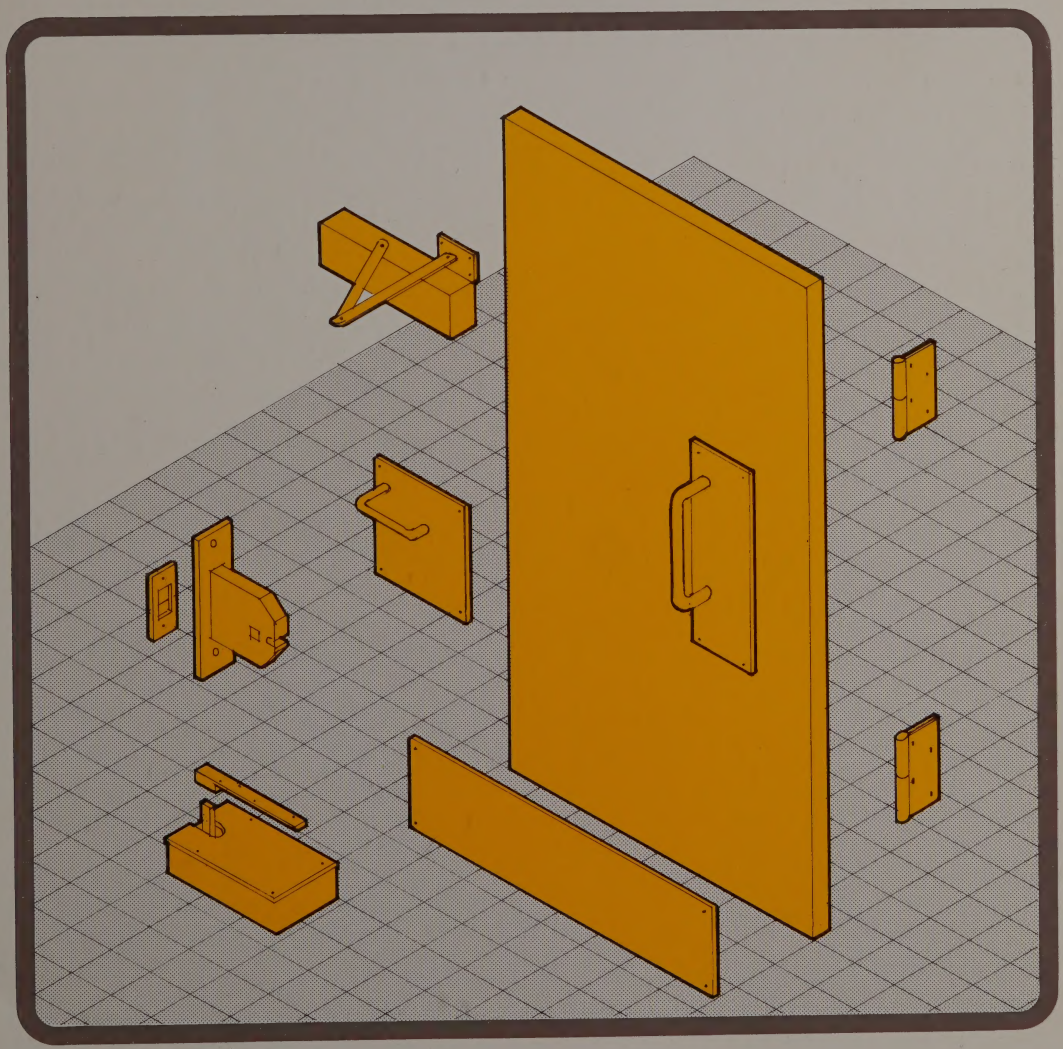
MC0013

Health Technical Memorandum

Building components

Ironmongery

59



Department of Health
and the Welsh Office

Health Technical Memorandum

Building components

Ironmongery

59

London:
Her Majesty's Stationery Office

©Crown copyright 1989
First published 1989
ISBN 0 11 321258 5

Contents

1 Introduction
1.1 Background
1.2 Scope and status
1.3 Relationship to other data
1.4 Terminology

2 General guidance
2.1 Basic considerations
2.2 Range of components
2.3 Functional requirements
2.3.1 General
2.3.2 Common usage considerations
2.3.3 Ironmongery for fire-resisting doorsets
2.4 Fixing door ironmongery
2.5 Suiting of locks
2.6 Material, colour, and finish

3 Selection/application
3.1 Introduction
3.2 Standards and tests
3.3 Hanging
3.3.1 General
3.3.2 Hinges
3.3.3 Pivots
3.3.4 Sliding gear
3.4 Operating
3.4.1 General
3.4.2 Floor springs
3.4.3 Overhead closers
3.4.4 Middle rail closers
3.4.5 Automatic controls
3.5 Securing
3.5.1 General
3.5.2 Locks
3.5.3 Latches
3.5.4 Catches
3.5.5 Bolts

3.6 Furniture
3.6.1 General
3.6.2 Lever handles
3.6.3 Pull handles
3.6.4 Plates
3.6.5 Escutcheons
3.6.6 Buffers
3.6.7 Limit stays
3.6.8 Holders
3.6.9 Grilles
3.6.10 Seals

4 Project documentation
4.1 General
4.2 Schedules
4.3 Specification
4.4 Bills of quantities

5 Procurement
5.1 General
5.2 Sets or ironmongery
5.3 Ordering

6 Site practice
6.1 General
6.2 Product data
6.3 Custody of securing devices
6.4 Morticing

7 Maintenance
7.1 Project maintenance manual
7.2 Planned maintenance
7.3 Lubrication and cleaning

Appendices
A Recommended fixing positions for ironmongery
B Schedules and codes
C Operating forces of door closers
D Specification for hinges

References

1 Introduction

1.1 Background

This is one of a series of *Health Technical Memoranda* which provide specification and design guidance on building components for health buildings which are not adequately covered by current British Standards.

The series supersedes all current Component Data Base Mark 3 (and earlier Manufacturers Data Base) information.

The numbers and titles of the HTM in the series are:

54 Building Components
55 Windows
56 Partitions
57 Internal glazing
58 Internal doorsets
59 Ironmongery
60 Ceilings
61 Flooring
62 Demountable storage system
63 Fitted storage system
64 Sanitary assemblies
65 Signs
66 Cubicle curtain track
67 Laboratory fitting out systems
68 Duct and panel assemblies
69 Protection
70 Fixings

The technical information in this series is the result of research and development funded by the Department as part of collaborative working arrangements over a number of years between the Department, the NHS, and Industry through the medium of the Component Data Base.

Any enquiries regarding the technical content of this HTM should be directed to Health Building Directorate, Department of Health, Euston Tower, 286 Euston Road, London NW1 3DN.

1.2 Scope and status

This HTM contains guidance (or refers to other authoratative sources of information) on ironmongery which will meet the general requirements of users and conditions of use in health buildings.

With regard to the many other types of fitting traditionally classed as ironmongery:

- window fittings (see HTM 55) have to an increasing extent been developed as integral parts of a window and are therefore not a subject for separate specification guidance as ironmongery
- guidance on items such as buffer rails and grab rails is dealt with as ergonomic data (see H B N, Common Areas and HTM 56, Partitions)
- guidance on items such as disposal sack holders, soap dispensers etc is dealt with as activity data, leading to procurement as items of equipment.

The guidance offered in this HTM relates mainly to new building work, but much of it is equally applicable to renewal of ironmongery in existing buildings (see also HTM 58, Internal doorsets).

Its content does not diminish either manufacturer responsibility for fitness for purpose of products, or design team responsibility for selection and application of them to meet health building user requirements.

Because of the wide ranging considerations necessary to successful selection, specification, installation, and use of ironmongery, this HTM should be made available to all those engaged in the briefing, design, production, construction, equipping, commissioning, and maintenance of health buildings.

1.3 Relationship to other data

The main sources of data used in the preparation of this HTM are listed in the References section.

This HTM was prepared for printing in August 1985 and revised in July 1989 and is based on data current at that date. Readers should ensure that they use the latest edition of all building legislation, British Standards, etc., and give first preference to products and services from sources which have been Registered under BSI Quality Assurance procedures, or other certification scheme.

Suppliers offering products to other than British Standards should provide evidence of at least comparable specifications.

1.4 Terminology

In this HTM the following terms apply.

Ironmongery – components sometimes referred to as 'architectural ironmongery', or 'builders hardware', which are fitted mainly to door leaves and frames for the purposes of hanging, operating, and securing the leaf or leaves in the frame and to provide the necessary operational fixtures and fittings.

Doorset – an assembly comprising a frame, a leaf or leaves, and hanging devices, fitted and matched in a factory, delivered to site as a composite unit.

Door assembly – an assembly as above but with the parts delivered to site from separate sources, and assembled on site to form a composite unit.

Configuration – refers to the number and mode of operation of the leaves of a doorset or door assembly.

Grade – refers to the nature and degree of usage of a doorset or door assembly, eg medium duty, heavy duty, fire-resisting.

2 General guidance

2.1 Basic considerations

Door ironmongery represents a very small proportion of the capital cost of a health building, but can have an entirely disproportionate effect on its performance.

If this effect is to be beneficial the ironmongery must be:

- appropriate to its function
- of good quality
- correctly fitted
- pleasing to the eye.

Total costs, ie capital costs plus maintenance costs may be reduced by the choice of robust, slightly more expensive items.

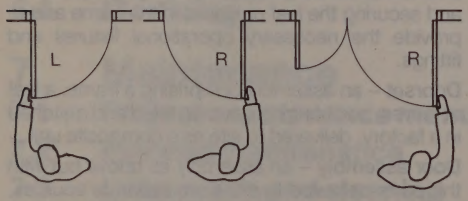
Currently there are few published standards or reference works on the subject (see References).

The essential minimum only of components should be specified, as complexity and over-provision will tend to confuse the users.

The incidence of users suffering from physical impairment or weakness is higher in health buildings than in other building types. This does not, however, necessitate provision throughout of special items, but rather to take account of their requirements in the overall design of doorways and selection of ironmongery, together with the requirements of fully mobile users. The needs of staff who may be carrying equipment or pushing trolleys etc should be borne in mind.

The selection of ironmongery is directly influenced by the configuration of the doorset, ie single leaf, leaf and a half, or double (equal) leaves, and whether they are single or double swing.

Handing of doors is probably the subject of more confusion than any other aspect of specification of ironmongery, the following graphics and definitions have been included:



Left hand Right hand Right hand

The handing of a door describes the direction of its swing. It is determined by the position of the hinge (or pivot) when viewed from the pull side of the door.

The handing of one and a half leaf doorsets is determined by reference to the larger leaf. Double doors with equal leaves, and doors which swing two ways are symmetrical and are not handed.

It should be noted that rebated meeting stiles of leaves are not recommended in health buildings, and this HTM makes no reference to special items of ironmongery required for such doorsets. See HTM58 Doorsets, section 2.8.1 page 6.

Designing special ironmongery components for health buildings is impracticable, uneconomic, and unnecessary, in view of the wide range of products available.

The best results will be achieved by careful attention to:

- functional requirements (see 2.3)
- off-site and on-site methods of fitting ironmongery
- material, colour, and finish
- availability and cost
- maintenance.

2.2 Range of components

For identification and selection purposes, ironmongery for doors can be classified under foor functional groups.

Hanging – items which carry a door leaf and enable it to swing or slide open and shut:

- hinges
- pivots
- sliding gear.

Operating – items which control the movement of a door leaf:

- floor springs
- overhead closers
- mid-rail closers
- automatic devices.

Securing – items which secure a door leaf in the closed position:

- locks
- latches
- catches
- bolts.

Furniture – items which contribute to the operation and functioning of a door:

- lever handles
- pull handles
- plates
- escutcheons
- buffers
- limit stays
- holders
- grilles
- seals.

2.3 Functional requirements

2.3.1 General

The selection of ironmongery will be influenced by the general specification of the door, whether new or existing, and each doorset or door assembly should be examined firstly from a user requirement point of view, and thence to how it is to be hung, operated and secured, and requirements of furniture.

Commonly occurring user requirements should be met by common solutions in terms of clearly identified sets of ironmongery for the building, and which, in cases of phased development, can be applied consistently throughout the project. Such grouping of ironmongery into sets can also be an invaluable guide to less experienced members of a design team, and can greatly simplify scheduling procedures.

Guidance in this HTM on locks and latches is based on a strong recommendation that these functions are kept separate wherever possible for the following reasons:

- each can be fitted at a level to suit their function
- changes in securing arrangements can be more easily made — locks can be fitted at any time
- the size of mortices and consequent weakening of the leaf is reduced to a minimum particularly middle rails and stiles in glazed doors.
- the greater mass of metal of combined lock/latch sets may present difficulties in fire resisting doorsets
- where doors are subject to the passage of beds, trolleys, persons encumbered by trays, handicapped or infirm people and are fitted with closing devices, latches should not be fitted. Pull handles and push plates only should be used.

Classification of doors in HTM58 Doorsets and BS DD171 with grades should also be followed for their ironmongery.

- Appendix D sets out four classes for hinges, as used in the draft BS for hinges under preparation in 1989 and the PSA "Method of Building" specification.
- BS6459 classifies door closers into size numbers.
- BS5872 (under revision in 1989) classifies locks and latches into the DD171 categories of duty.

2.3.2 Common usage considerations

Considerations	Notes
Location and severity of use: • frequent use (medium duty doors) • very frequent use (heavy duty doors)	Use by people likely to exercise care, eg doors in health buildings used mainly by staff, occassionally with small trolleys or carrying goods. Use by people less likely to exercise care, eg frequent passage by staff with heavy trolleys, beds or other bulky equipment. Consider some form of protection to doorsets.
Condition and operation: • door normally kept closed and manually opened and closed • door normally kept closed, manually opened and mechanically closed • door automatically operated • door normally held open and manually closed • door normally held open and mechanically closed • door nromally held open and closed automatically in an emergency • door normally kept locked	Consider effect on hinges, closing devices, provision of latching, locking and bolting.
Degree of exposure/air pressure: • not exposed to wind/air pressure • exposed to unequal constant pressure • exposed to unequal and fluctuating pressures	Lobby doors often affected, also rooms subject to positive air pressure (eg theatres and sterile laboratories) Closing forces of door closers may need to overcome air pressures – see Appendix C "Operating forces of door closers"
Users: • fit and unencumbered • fir but encumbered • disabled	The 'opening force' of door closers is a particularly relevant consideration and may highlight the need for automatic operation. For further information see: • BRE Report "An investigation of fire door closer forces". • BRE Information Paper IP 2/82 – "Ergonomic requirements for windows and doors". • BS 5810 – Code of practice for Access for the disabled to buildings. • Appendix C – "Operating forces of door closers"
Size, weight and grade of door leaf	• Refer to HTM 58 Internal doorsets, and to door manufacturers' literature. • A heavy duty or half hour fire-resisting door leaf may weigh from 20kg (500 leaf) to 30kg (900 leaf). • A one hour fire-resisting door leaf may weigh from 35kg (500 leaf to 65kg (900 leaf). • A door to a radiodiagnostic room may considerably exceed the above weights. • When assessing the 'as installed' weight of a door leaf, allowance must be made for all the ironmongery which will be added to the door, and the effect of any door closer.

2.3.3 Ironmongery for fire-resisting doorsets

The leaves of fire-resisting doorsets may be:

- normally locked shut
- normally shut – self closing
- held open – automatically closed.

A full range of fire-resisting doorsets to CDB designs have been tested and evaluated complete with ironmongery (see hTM58, Internal dorsets).

The fire resistance of doorsets can be affected by the ironmongery fixed to, or embodied in the door, and the following considerations should be borne in mind:

- hinges or pivots cut into and fixed to door leaves and frames, should be selected from products which are known to have been successfully tested and of known construction
- overhead closers which are face fixed, only need to hold doors closed until intumescent seals activate. Items successfully tested should be selected for use on doors of similar width and weight
- items morticed into a door leaf or frame reduce the fire resistance by removing material which could otherwise resist the passage of fire, and protection may need to be improved by the addition of intumescent materials around the ironmongery, in 60 mins FR doors this is essential
- pass through items such as lever handles or locks which cut through a door leaf, must be selected from those successfully tested on a doorset of similar construction. Manufacturers of proprietary doors should be consulted with regard to accommodating ironmongery items on fire-resisting doorsets
- face fixed items such as pull handles, plates, etc. do not affect the fire resistance of a door, and therefore can be used on any fire-resisting doorset
- smoke and draught seals or brushes require great care in selection and installation, to ensure that such items do not detract from the proper functioning of the doorset (see HTM 58 Internal doorsets)
- where floor springs or overhead closers are fitted to fire-resisting doors, and have a stand open function, this latter must be automatically overridden by the fire alarm system.

For further information, see:

- The Association of Builders Hardware Manufacturers Code of Practice for hardware essential to the optimum performance of fire-resisting timber doorsets.
- Guild of Architectural Ironmongers, Code of Practice No 1. Architectural Ironmongery suitable for use on:
  - fire-resisting self-closing timber doors
  - emergency exit doors.
- CDB model working drawings and specification for 30 and 60 min Fire-resisting doorsets.

2.4 Fixing door ironmongery

The correct selection and fitting of ironmongery are essential to the proper performance of a door, and it is necessary to consider ironmongery as an integral part of a doorset or door assembly from the earliest design stage.

Ideally, door ironmongery should be fitted at the factory as part of the process of manufacture – a procedure widely accepted for windows. This may involve changes from traditional practice, but is strongly recommended, as being liekly to achieve a major improvement in performance and user satisfaction.

The following points should also be borne in mind:

- lift off hinges need very accurate fitting to ensure proper load distribution, and this can normally only be achieved by the use of a jig
- rounded forends and striking plates should be specified to suit machine operations
- fire-resisting doorsets need particularly accurate fitting of locks, latches and bolts to obviate voids
- the doorset should be factory morticed for recessed items factory prepared for site fitting of projecting items, thus reducing any damage to the latter in the course of delivery and installation
- automatically operated doorsets are normally supplied complete with all ironmongery
- factory fitting of ironmongery is standard practice for metal doorsets.

Recommended fixing positions for doorset ironmongery are illustrated in Appendix A and the following points regarding fixing should be noted:

- fixing blocks in the correct locations must be embodied in the fabrication of door leaves which are not of solid core construction
- mineral cored doors may require the use of special ironmongery or fixing methods
- the majority of items are supplied complete with fixing screws by the manufacturer, but screws for hinges are commonly supplied by the merchant and should be as recommended by the manufacturer. In the absence of such recommendations care should be exercised in selecting screws of the appropriate length, gauge, and pattern to suit the items to be fixed and the form of constructionm and material(s) to be fixed to. In general 'twin-fast' cross-head screws are preferred for fixing to timber or chipboard and special screws are often required such as:
  - non-ferrous for hardwood
  - clutch-head for secure areas.

For exposed fixings to door frames, glazing beads and the like, flush sockets or screw head covers should be specified.

2.5 Suiting of locks

Suiting of locks refers to a group or suite of doors the lock to each of which can be operated by two different keys thus:

- a servant key which will operate only the one lock
- a master key which will operate any lock in the suite.

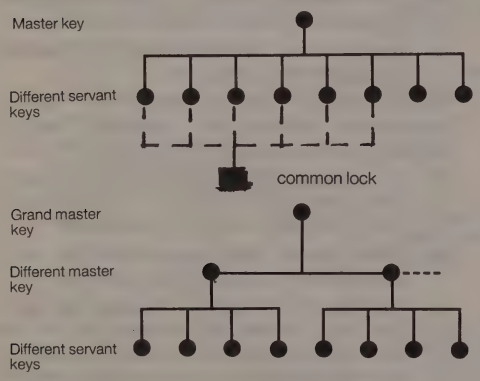
or by three different keys thus:

- a servant key which will operate only the one lock
- a master key which will operate any lock in the suite
- a grand master key which will operate any lock in two or more different suites.

It is often required that several servant keys should be able to operate one common lock, e.g. an entrance door lock. This is known as "central locking".

Contrary to common belief the suiting of locks diminishes security, ie for maximum security a lock should be operable by only one key.

Suiting of locks is therefore solely a matter of convenience to the users at two or three levels of management responsibility as illustrated in the following diagrams:



Suited locks are manufactured for specific requirements and not to stock. Consequently they are more expensive than non-suited locks, and sufficient time must be allowed for delivery.

2.6 Material, colour and finish

The process of selecting individual items of ironmongery must include consideration of overall visual compatibility of material, colour, and finish. This will be particularly important for items of furniture, but should as far as practicable cover all functional groups, and in all cases be based on samples.

The specifier may decide to ensure compatibility of these aspects and of overall design and 'style' by selecting items from one of the co-ordinated ranges on the market. However, it should be noted that while thise will solve the problems of compatibility, all items in a proprietary range may not be funtionally the best or the most cost effective of their respective types.

In all cases the environmental conditions in which the items will be required to function must be considered, and in particular the protection against corrosion of all items from the time of delivery to site to the stage at which the building is commissioned and temperature and humidity have been brought under control.

3 Selection/application

3.1 Introduction

This section contains technical guidance on the selection and application of doorset (or door assembly) ironmongery products, set out under the four functional group headings referred to in 2.2 namely:

- Hanging (see 3.3)
- Operating (see 3.4)
- Securing (see 3.5)
- Furniture (see 3.6)

3.2 Standards and tests

Although many ironmongery components are not fully covered by British Standards, the materials and finishes in which they are commonly made are fairly comprehensively covered several British Standards are at present being revised to give improved specifications and graded standards.

Doors in clinical areas are commonly operated between 100,000 and 200,000 times per annum, therefore manufacturers should be required to supply evidence of tests to at least 500,000 operations for hinges, pivots, overhead closers and floor springs. 100,000 to 200,000 operations should be requested for bolts, locks, latches and handles.

3.3 Hanging

3.3.1 General

Components which support the weight of the door leaf and enable it to be operated, should be selected first, viz:

- hinges
- pivots
- sliding gear

(floor springs which support and operate a door leaf, are dealt with in 3.4.2).

The most appropriate of these methods of support should be determined by functional requirements under the following considerations:

- size and weight of leaf
- configuration of doorset or door assembly
- grade
- method of operation.

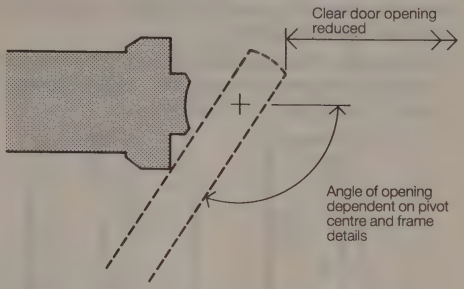
Taking each of these in turn:

Size and weight of leaf

Sizes and weights of health building doorsets commonly range from 20kg for a 500 wide medium duty leaf, to 65kg for a 900 wide 60 mins fire-resisting leaf. The frequency of operation is important in that medium duty leaves normally held open can be hung on hinges, while large, heavy, and frequently operated leaves should be set on floor springs. In the case of hinges, requirements for a pair or pair-and-a-half will need to be determined by the size and weight of the leaf in relation to the type of hinge.

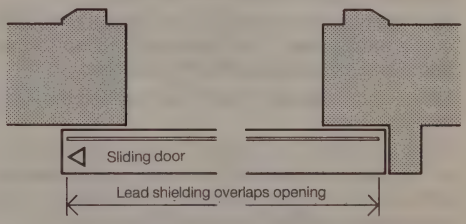
Configuration of doorset or door assembly

This will directly determine the method of hanging. For example double swing leaves must be hung on pivots or set on floor springs, and allowances made for the resultant reduction of clear opening and possible limitation of swing (see below).



Grade

The grade of a doorset or door assembly will largely determine its weight and the choice of ironmongery, eg fire-resisting door leaves should be hung on steel hinges. X-ray resisting door leaves can, with benefit, be hung on sliding gear because of their excessive weight and the greater facility for shielding which sliding action affords (see below).



Method of operating

The opening and closing operations may be effected manually or mechanically, and the choice of method may influence decisions on the method of hanging. For example, mechanical closing of single-swing leaves can be readily achieved by overhead closers, whilst the mechanical closing of double-swing leaves can be achieved with floor springs which also provide support. Automatic opening and closing of leaves will be simpler to achieve if they are hung on sliding gear.

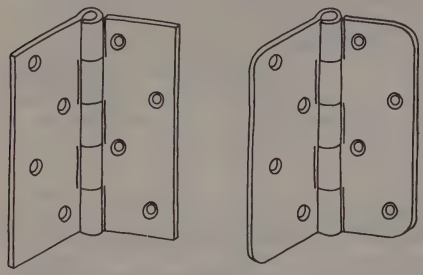
Generally, once the nethod of hanging a leaf has been determined, it is important to match the grade of ironmongery component to the size and weight of the leaf. In the case of factory made doorsets the doorset supplier is responsible for supplying correctly matched hanging components. In the case of door assemblies, the specifier carries full responsibility for the decision, and should check the weight of the door leaf including its ironmongery, and refer to manufacturers for advice on the appropriate grade of component.

3.3.2 Hinges

Hinges are available in a number of sizes and grades to suit different loadings, and most are available in a variety of forms, materials, and finishes.

Appendix D sets out performance requirements for door hinges and is based on draft PSA and British Standard specifications.

The majority of hinges are intended to be housed into the frame and the door leaf, as an essential basis for the strength of their fixings.



Hinge leaves may have square or rounded corners (as illustrated above), the latter being designed to suit machine routing of housings.

All knuckle hinges have an odd number of knuckles, and the part with the greater number of knuckles should be fitted to the frame.

All lift-off hinges are handed, and consist of a male and a female part. The male part is fitted to the frame and the female part to the door leaf.

Lift-off and loose pin hinges must be fitted the right way up.

It is important to ensure that all hinges are accurately positioned and plumbed one above the other, and that they are fixed with screws of the appropriate material, type, gauge, and length.

Metal frames are usually supplied with the hinges attached.

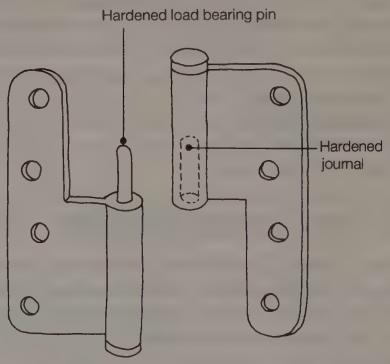
The majority of health building requirements for hinges will be met by the following six types:

- lift off
- loose pin
- fixed pin
- ball bearing
- rising
- falling

These are dealt with in the following paragraphs.

Lift off hinges with journal bearings
These normally transfer the weight of the door leaf onto the tops of the hinge pins. It is difficult to ensure even distribution of load onto two or more such hinges as it is unlikely that all the pins will penetrate their matching sockets to precisely the same depth. It is therefore essential that the topmost hinge should carry the weight of the door leaf, leaving the lower hinge(s) to act as locating pivots.

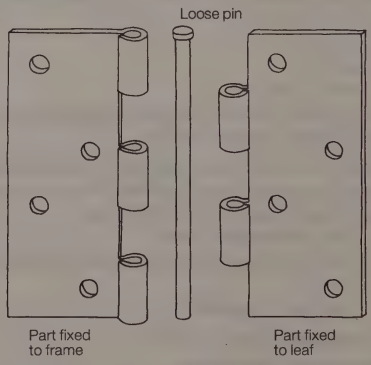
Such hinges are recommended for general application, including heavy duty performance (for which three per leaf are usually required). To achieve the necessary accuracy of fitting they should only be specified for factory assembled doorsets. The facility to easily remove and replace a door leaf which they afford can be of considerable benefit.



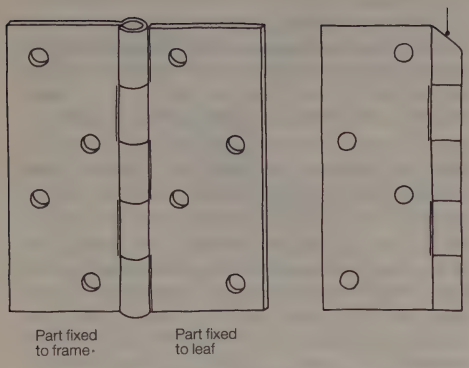
Lift off hinges with bearing washers at meeting surfaces are also available.

Loose pin hinges (a type of knuckle hinge)
These have a centre pin which can be inserted and withdrawn as required. Care should be taken when fitting them to ensure that the hinge is the right way up with the pin inserted from the top. They have the same demountability advantages as lift off hinges, but do not call for the same degree of accuracy in fitting.

As the pins can be removed with the leaf in the closed position, this facility will conflict with security requirements. Hinge bolts will be required for security (see 3.5.5).

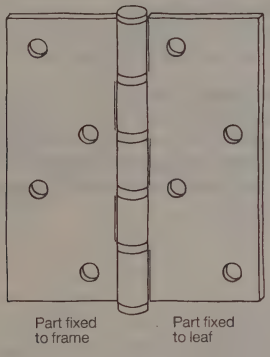


Fixed pin hinges
These are the most common and universally applicable type of hinge, and can be supplied with a shouldered knuckle (see below) where the projection of the knuckle may be a potential hazard (eg to disturbed patients).



Ball bearing hinges

These have ball races at the wearing surfaces, and are available in fixed pin, loose pin, and lift off versions.

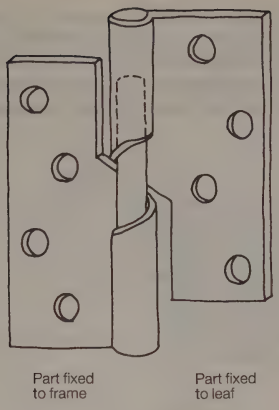


Rising hinges

These raise the leaf as it is opened, and are essentially a form of lift off hinge in two parts, with the bearing faces cut to a spiral and machined and hardened for smooth operation.

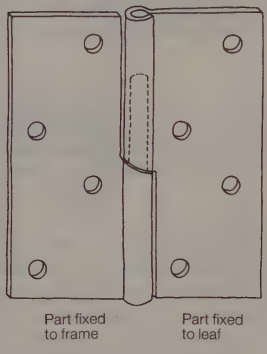
The main advantages of the rising action are that:

- the leaf is raised clear of carpet pile which could otherwise impede the leaf swing, and cause wearing of the floor covering
- some self closing action is provided, although this is not sufficient either for fire containment purposes or to overcome the resistance of a latch.



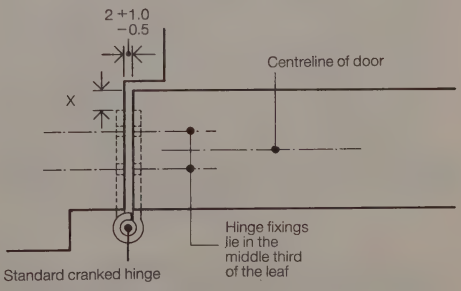
Falling hinges

These are similar to rising hinges, but with the spiral formed in such a way that the leaf falls open unless secured in the closed position. For this reason, they are commonly used to hang w.c. cubicle leaves.

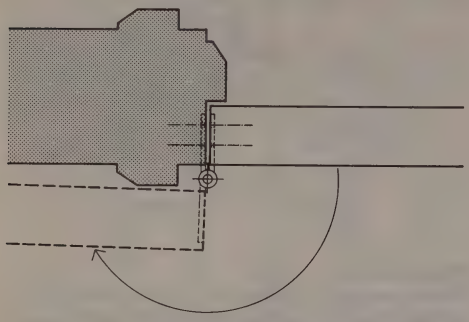


Selection and specification of hinges

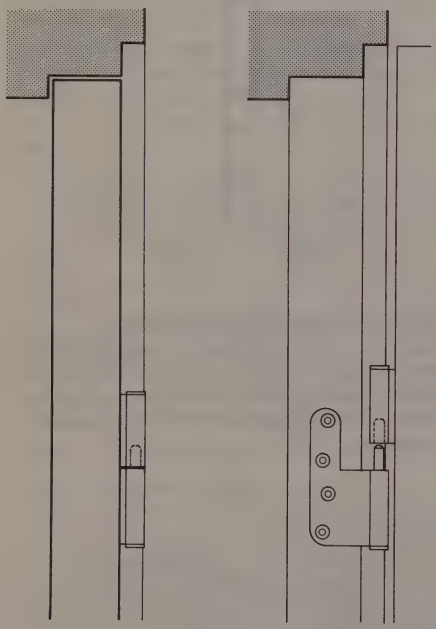
The width of hinge leaf should be such that fixing screws will lie in the middle third pf the leaf thickness (see illustration below), and allowing a sufficient margin of material on the hanging edge of the leaf (at x).



Also, to achieve the 180° swing which should be specified wherever practicable in health buildings, consideration will need to be given to the location of the hinge pivot in relation to the face of the leaf and frame, and to the profile of the architrave (see illustration below).



Similar consideration of pivot location and architrave detail will need to be given at the head of leaf and frame where lift-off hinges are specified, to ensure that the leaf can be lifted off without obstruction (see illustration below).



Door closed

Door open and lifted off

The weight of the leaf and the frequency of use of the door will determine whether a third hinge is required, and the location if required. Generally, manufacturers of knuckle hinges recommend that a third hinge be fitted midway between top and bottom hinges, whereas manufacturers of lift off hinges recommend that a third hinge be fitted close to the top hinge (see Appendix A showing recommended fixing positions for ironmongery).

The additional forces exerted on the hinges by overhead closers should also be considered when selecting and locating hinges on a leaf, and the location of a third hinge at the high level may assist.

The last step in selecting and specifying hinges will be to reconcile the above considerations with what is on offer in manufacturers' catalogues, and to relate leaf weights to be supported, to the load bearing capacity of specific hinge products available, and the manufacturers recommendations for locating and fitting them.

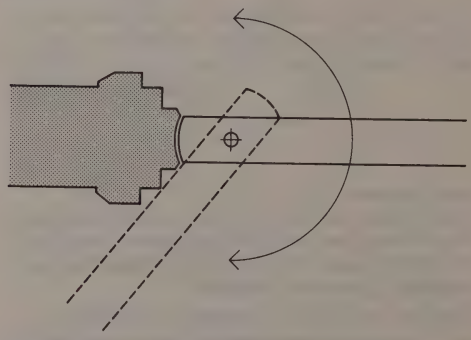
3.3.3 Pivots

Pivot sets are available in two basic forms:

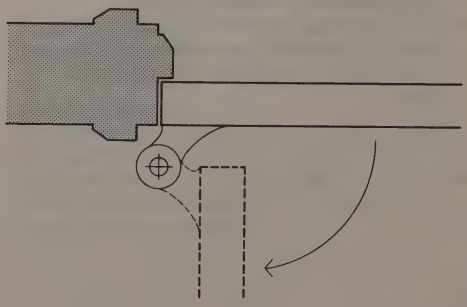
- bottom bearing; in which the weight of the leaf is carried at floor level
- top hung; in which the weight of the leaf is carried by the head of the frame.

Bottom bearing pivot sets

These are available in two forms for single swing and double swing leaves. In the former case the pivot is offset from the centre line of the leaf; and in the latter case is located on the leaf centre-line (see illustrations below).



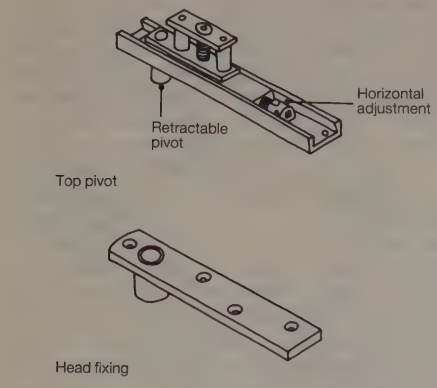
Double swing



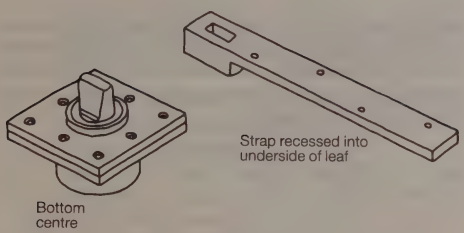
Single swing

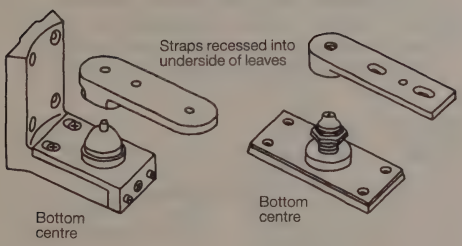
Typical bottom bearing pivot sets comprise:

In the case of heavy single swing leaves this type of pivot provides a suitable alternative to hinges.



Top pivot and head fixing

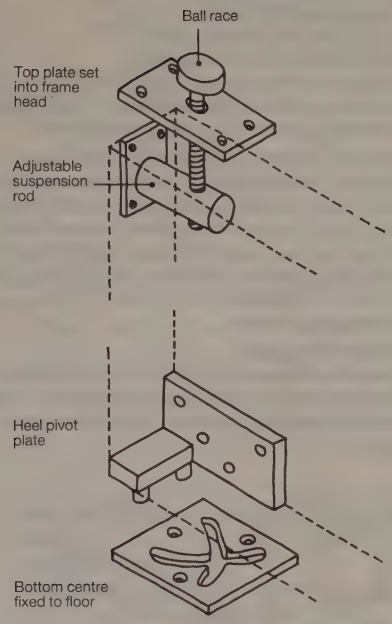




Heel fixings and bottom bearing centre or spindle

Top hung pivot set

This type is available for single swing and double swing leaves with optional stand open facility. The leaf is hung from the head of the frame, and the set comprises:



The action of opening the leaf causes it to tilt, producing a closure action by gravity. This action is therefore directly proportional to the weight of the leaf and is unchecked.

Experience has shown that these can be susceptible to wind forces, resistance from edge seals, overswing problems and difficulties of fitting and adjustment to suit the wide range of widths and weights of doors and building movements. They are not recommended for general use on Fire resisting doorsets. These pivots however can be very useful in assisted bathroom and wc doors where their easy opening action can assist handicapped users.

Generally pivot sets require accurate fitting, and products which incorporate provision for adjustment of the leaf position, and retraction of the top pivot are preferred.

Pivot sets are particularly suitable for providing emergency release of leaves in patient bathroom and toilet doorsets. In such cases the leaf should be hung on a double action pivot set, and held shut with an indicator bolt with facility for releasing the bolt from outside. For normal use the leaf action is single swing against a special retractable or removable stop on the frame, which latter, for emergency access is retracted or removed to allow the leaf to swing outward.

3.3.4 Sliding gear

Sliding gear is available in two forms:

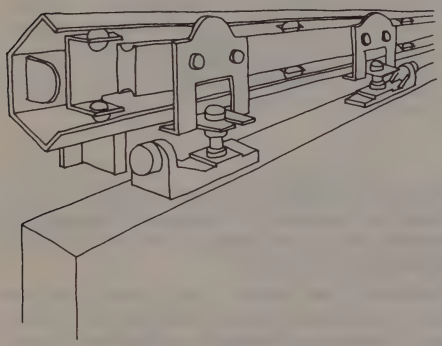
- top hung with bottom guide
- bottom bearing with top guide

and in a number of grades to suit different loadings, and a variety of materials and finishes. Sets of gear are normally supplied to operate a single leaf.

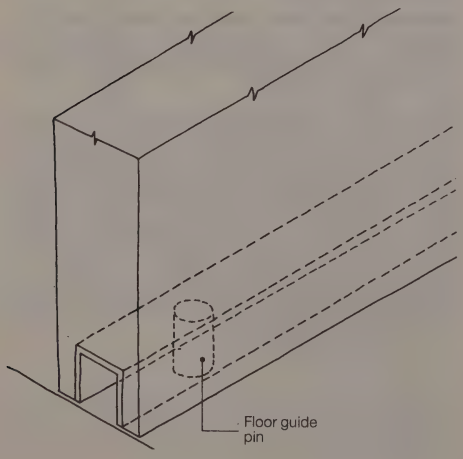
Sliding action offers advantages where space is restricted or where screening of the opening (as in X-ray rooms) is required, and exceptionally heavy leaves have to be supported. Also sliding action,can be more readily rendered self closing by the use of counter weights, and, if for fire protection, activated by fusible link or electromagnetic release.

Top hung sliding gear

This transfers the weight of the leaf to the partition via the channel track, and is suitable for most situations given that the partition is capable of taking the loads.

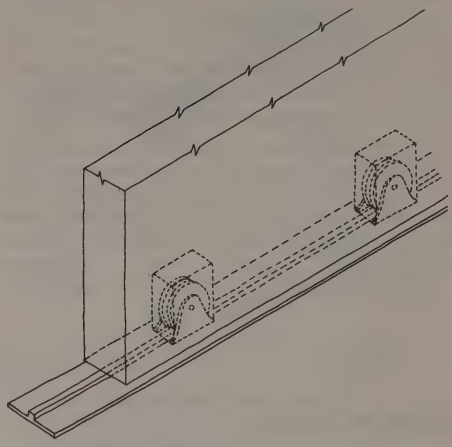


The channel track will normally need to be concealed by a pelmet board (removable for maintenance), but the guide at floor level which operates in a channel let into the bottom edge of the leaf remains concealed within the width of the leaf, leaving the floor otherwise entirely clear.

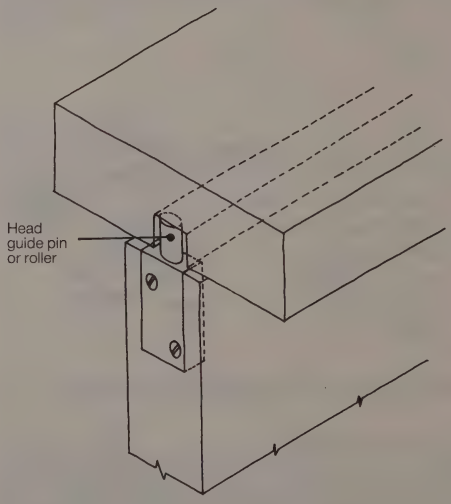


Bottom bearing sliding gear

This transfers the weight of the leaf onto a floor mounted track via wheels let into the bottom edge of the leaf.



For this reason it is best suited to supporting heavy leaves but has the disadvantage of the track at floor level. The top guides are usually let into the vertical edges of the leaf and engage in a channel in the head of the door frame.



Selection of manufacturers' products under each of the above heads will be determined by the load bearing capacity of the top hung version and smoothness of operation. The latter aspect will apply equally to the bottom bearing version, together with consideration of the size of the housings required in the bottom edge of the leaf, in relation to leaf thickness.

3.4 Operating

3.4.1 General

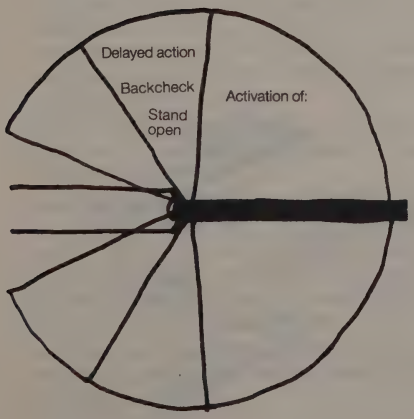
The means of opening and closing a door leaf should be the next consideration. Either or both of these actions can be effected manually or mechanically. Clearly manual operation is the cheaper, both in initial cost and maintenance cost, and the specification of mechanical devices should be approached with caution, and be soundly based on user needs and benefits, and fire and other safety requirements.

Mechanical devices fall under four heads:

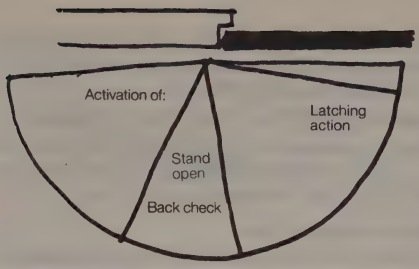
- floor springs (see 3.4.2)
- overhead closers (see 3.4.3)
- middle rail closers (see 3.4.4
- automatic controls (see 3.4.5)

Floor sprins and closers derive power from the action of the leaf, which compresses a spring, which then reacts to close the leaf. In its simplest form this is no more than a slamming action, but in more sophisticated devices the closing action is controlled by hydraulic 'damping'. Other built in functions available are:

- latching action which accelerates closure through the last few degrees of a single swing action to overcome the resistance of a seal or latch
- delayed action which slows the closing action for a predetermined period before allowing it to close at normal speed
- stand open which holds the leaf open at about 90° until a pull action or alarm system activates the automatic relase
- back check which is an in-built buffer which prevents the leaf being flung wide open
- alarm activated which ensures through connection to the fire alarm system that the leaf is closed when the alarm is activated.



Double Swing



Single Swing

There are two forms of alarm activated mechanical closure:

- those which employ an electro-magnetic device to hold the leaf open against the pressure of a floor spring, overhead closer or middle rail closer; and which is released to allow the leaf to close when activated by the fire alarm system. These are known as 'detentes'
- those which in normal use of the leaf exert no closing action, until activated by the fire alarm system. These are known as 'free swing closers'.

The choice of appropriate mechanical devices will be determined by the following:

- location/degree of use
- grade
- operating force
- size and weight of leaf
- configuration.

Location/degree of use

In locations involving frequent passage of mobile equipment, but also requiring the leaf to be closed when not in use, automatic opening and closing controls may be justified, eg hospital entrance.

However, it is acceptable that the leaf (or leaves) remain open, then mechanical closure with stand open facility (or detantes if a fire door) will suffice.

In assessing degree of use, a distinction should be made between heavily used doorways and heavily used doors. Doors which are normally held open will have only a light usage however much traffic passes through them.

Grade

The functional grade of a doorset or door assembly will directly influence the selection of mechanical closing devices. For example, middle rail closers will not normally be suitable for fire-resisting grade doors, and the choice will lie between floor springs and overhead closers.

Operating force

In selecting a closing device capable of closing a leaf of given size and weight, the appropriate balance must be struck between such necessary closure force and the force to be exerted by the

users to open the leaf. It is this relationship which determines the efficiency of a closer, and which can be calculated as a percentage.

An efficiency of 50% to 70% should be aimed at.

In health buildings, the range of user capability to open a door against mechanical closure is in the 35N-65N range. See Appendix C.

Size and weight of leaf
The larger the surface area of the leaf, the greater the resistance to opening and closing from air pressure; particularly in areas where positive/ negative air pressure is present. Also the heavier the leaf, the greater the forces required to set it in motion and control it.

Configuration
Configuration will directly influence the choice of mechanical closing devices. For example, double swing leaves can only be operated by floor springs, but for single swing leaves the choice (subject to the many other factors referred to above) can range between floor springs, middle rail closers, and overhead closers.

Generally, when selecting mechanical closing devices, it should be appreciated that components which are undersized for the required function will fail, and if oversized may render the door difficult to use by fully capable users, and unusable by the less able users.

In all cases, ie manual or mechanical operation, buffering should always be provided to protect:

- the closing device against over-extension (closers designed to open to 180° do not require this)
- the door frame from excessive impact from closure of the leaf
- the adjacent wall surfaces and door ironmongery from impact damage.

Overhead transom closers have generally been found to be unsuitable in health buildings. On Fire resisting doorsets it is almost impossible to retain the fire resistant properties of the door and frame.

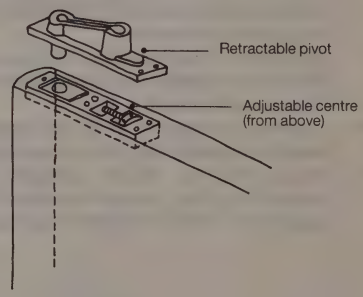
3.4.2 Floor springs

A floor spring supports and operates a leaf, and is therefore one of the most sophisticated of the four methods of mechanical closure listed in **3.4.1**.

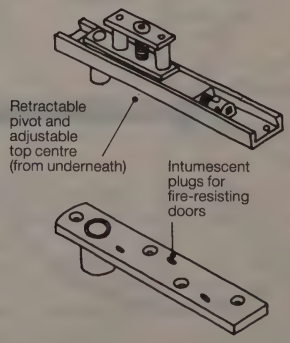
They are available in two versions to suit single and double swing leaves, and whereas the first of these is but one method available for mechanically closing a single swing, the latter is the only suitable means for mechanical closing of double swing leaves in health buildings.

Floor springs are available to suit a wide range of sizes and weights of leaf, up to the largest and heaviest, and with the optional additional functions described in **3.4.1**.

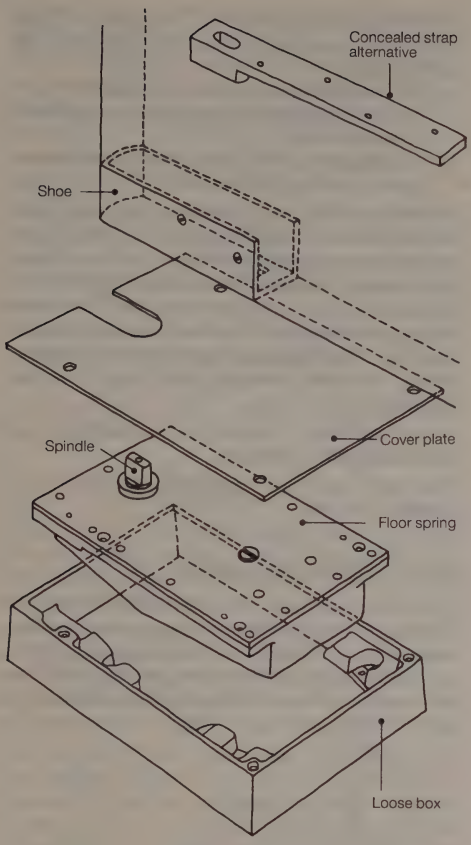
The constituent parts of a floor spring assembly are illustrated below. A feature strongly recommended for health buildings is the loose box which enables the location of the power unit to be adjusted horizontally and vertically, to locate the door leaf precisely in position. This box must be sealed at floor level, to prevent ingress of moisture. The overall depth of the unit should be compatible with the specified depth of screed to avoid cutting into the structural floor. The cover plate should be in stainless steel, and must be sufficiently rigid to avoid deflection under wheel loads.



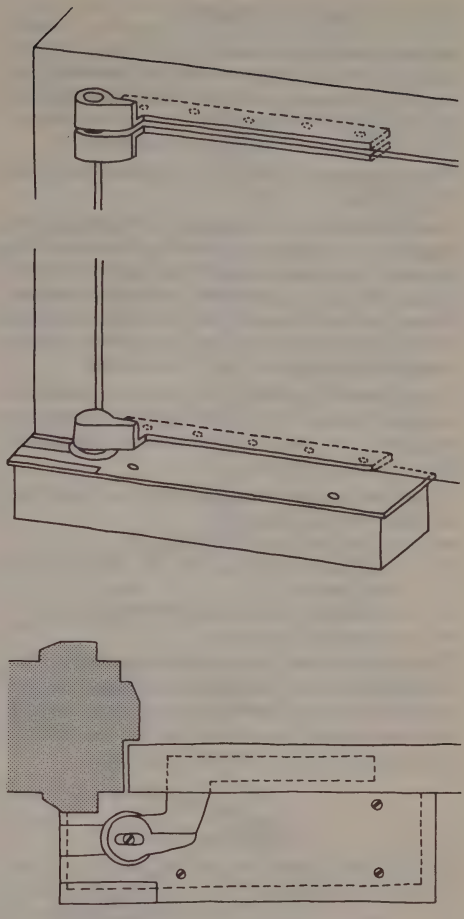
Top centre



Alternative top centre



Floor spring



Single swing floor spring with offset pivot

All functions of a floor spring, including any ancillary functions, should be adjustable after the unit has been installed. This is important not only for initial installation, but also for later adjustments. In particular spring strength should be variable either by adjustment or replacement.

Some manufacturers provide interchangeable spindles, of different applications eg for use with deep pile carpets.

Heel fixings are commonly available in the form of a concealed bottom strap, or exposed shoe. The shoe is to be preferred as it provides greater support for the leaf, and better fixing. Special "bolt-on" and "heel-less" shoes are available for use on FR or doors of special construction.

In Fire resisting doorsets evidence of a successful fire test on a door of appropriate construction should be verified.

A retractable top pivot is essential for the installation of double swing leaves, and horizontal adjustment is also required. This facility is not necessary for single swing doors, because the pivot is located outside the thickness of the leaf, and is therefore accessible.

When floor springs are specified, consideration should be given to the provision of a timber cill, to enable factory fitting of the unit.

Floor springs are particularly recommended for large, heavy, and frequently used leaves.

(See also Section 7 regarding maintenance of floor springs.)

3.4.3 Overhead closers

An overhead closer is a mechanical device for closing a single swing leaf through (nominally) 90° or 180°, operating at or near doorhead height. All the built in functions listed in 3.4.1 can be provided. The 180° opening facility is to be preferred.

These closers should be in accordance with BS6459 Part 1.

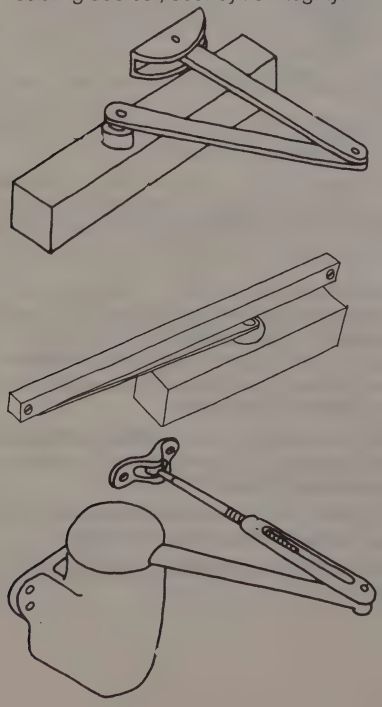
They are available to suit a range of leaf sizes and weights, and it should be noted that those with the capacity to operate exceptionally wide and heavy leaves, transfer considerable stress to the hinges, frame, and the adjacent wall or partition, and may render the leaf difficult to operate by users. In these cases floor springs may be more suitable.

They consist of a power unit containing a spring in hydraulic fluid, and arms attached to the frame and the power unit, which latter is normally attached to the 'pull' face of the leaf.

Other versions are available with the power unit designed for mounting:

- on the 'push' face of the leaf, or
- underneath the head of the frame on the 'push' side, or
- concealed in the top edge of the leaf, or
- concealed in the frame.

Generally, all these other versions are mechanically less efficient and in the case of concealed versions require such large morticesd in leaf or frame as to severely reduce their strength, and in the case of a fire-resisting doorset, destroy its integrity.



For the above types of closer, the full extent of leaf swing and operating efficiency generally, will depend upon:

- the location of the power unit in relation to the hanging edge of the leaf, and the length of the cranked arms
- the location of the attachment of the cranked arm to the face of the frame.

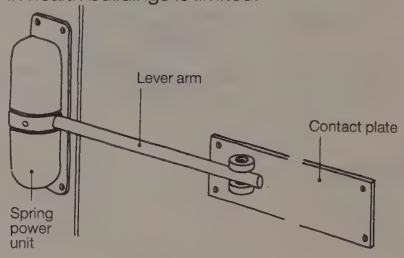
In the case of the latter, the fixing should be direct to the frame and never to an architrave. In all cases the required extent of leaf swing must be matched by the range of action of the closer. In practice this will mean selecting either a closer which operates through a nominal 90° where the leaf swing is limited, for example by a flank partition, or a closer which operates through 180° for all other situations.

Some overhead closers are available with adjustable spring strength.

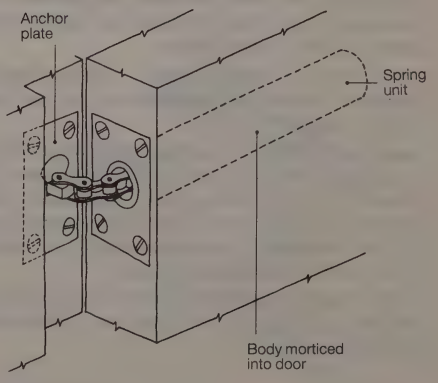
(See also Section 7, regarding maintenance of overhead closers.)

3.4.4 Middle rail closers

A middle rail closer is a mechanical device for closing a leaf, operating mid-way between floor level and doorhead. The two available types, surface mounted and morticed, are dealt with here but users should appreciate that their suitability for use in health buildings is limited.



Middle rail closer



Middle rail closer

The surface mounted version can only be used on single swing leaves:

The morticed version which can be used for both single and double swing leaves, comprises a spring enclosed in a tube, and is connected to an anchor plate by a chain. The spring is morticed into the back edge of the leaf, and the anchor plate is sunk flush into the reveal of the frame, thus:

Most face fixed versions are without 'damping action', so that control of the swing of the leaf to ensure suitably quiet closure will need to be provided separately. Some morticed closers have a check action.

Generally, use of middle rail closers should be limited to lighter weight leaves which will have relatively moderate usage.

They are not normally suitable for use on fire-resisting doors.

3.4.5 Automatic controls

These provide automatic opening and closing of swing or sliding leaves. They consist of a power unit, sensors, control unit, and the necessary wired connections between them.

The sensors may be in the form of:

- pressure pads in the floor
- an overhead 'magic eye'
- a horizontal light beam
- an infra-red device.

The sensors are positioned to cover the approaches to the door from both sides. At the approach of the user the sensor transmits a signal via the control unit to the power unit, which opens the leaf (or leaves). After a time delay, sufficient to allow the user to pass well clear of the opening, the action is reversed to close the leaf (or leaves).

When considering the type of sensor to be employed it should be noted that:

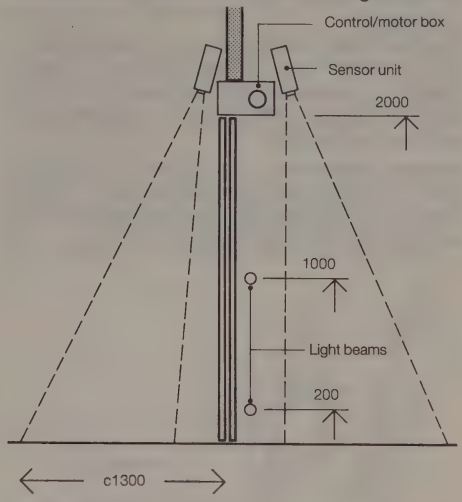
- safety is the most important requirement, and in the event of loss of power it must be possible to operate the system manually. In the case of sliding leaves, it is possible to mount the sensor in the leading edge of the leaf, which reverses a closing action likely to trap the user
- pressure pads set into the floor may present installation and maintenance difficulties
- infra-red devices respond to body heat but not to inanimate objects, eg trolleys

In view of their relatively high initial and maintenance costs, the specification of controls of this type will need to be very fully justified by the location, and amount of traffic.

A device to adjust the opening and closing speed should be provided.

The method of operation, either by electricity or compressed air, should be decided at an early stage and appropriate provision made for the engineering services and in the structure.

Controls of this type will normally be supplied and installed by a specialist firm and normally form part of a package including doors, frame, sensors and power units. Builders work and engineering services must be included in the building contract.



Automatic controls

Installations should be in accordance with BS7036 "Provision and installation of safety devices for automatic power operated pedestrian door systems".

3.5 Securing

3.5.1 General

Decisions on supporting and operating a door leaf should be followed by consideration of the means of securing it in the closed position.

This can take one or more of the following forms, according to user requirements, viz:

- locks (see 3.5.2)
- latches (see 3.5.3)
- catches (see 3.5.4)
- bolts (see 3.5.5)

Selection should take into account location and severity of use as in 2.3.2.

Where automatic controls with proper provision for security are to be installed none of the above will be necessary.

3.5.2 Locks

Locks should only be specified where it is a client requirement that access is to be limited as and when necessary to key holders.

Locks can be categorised as follows:

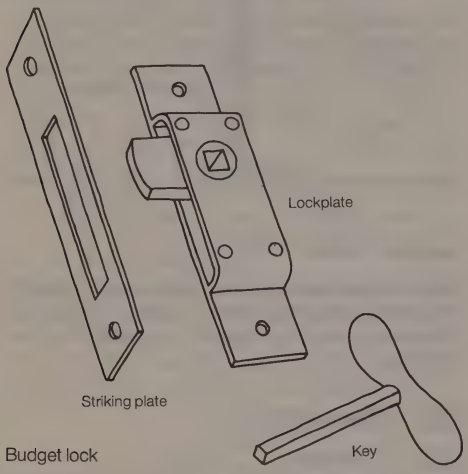
- **deadlocks,** comprising:
  - budget locks
  - mortice lever deadlocks*
  - mortice cylinder deadlocks
  - escape locks.

- **sprung locks,** comprising:
  - cylinder locks
  - lever locks*. Lever locks are not covered by the guidance in this HTM because they are generally unsuitable for use in health buildings.

Deadlocks

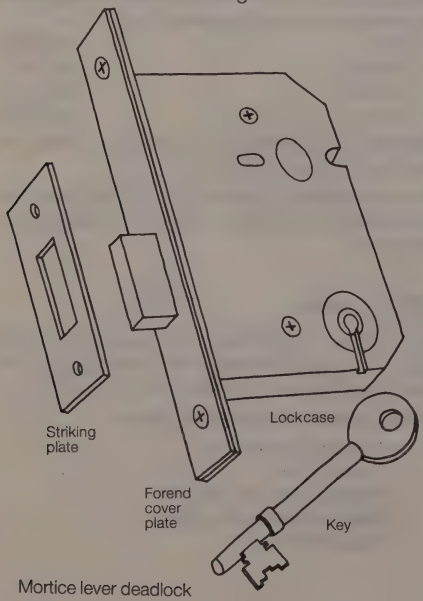
These are locks in which the bolt is manipulated by key or thumb turn, as opposed to a spring, requiring a positive decision by the user to lock the door and consequently involve a more conscious application of security.

Budget locks are the simplest form of deadlock, which are face fixed and operated by a square ended key. They are best suited to securing access panels to ducts etc, and cupboard doors.



Budget lock

Mortice lever deadlocks consist essentially of a morticed lock case with a cover plate, a striking plate and key. They are not recommended for general use in health buildings.

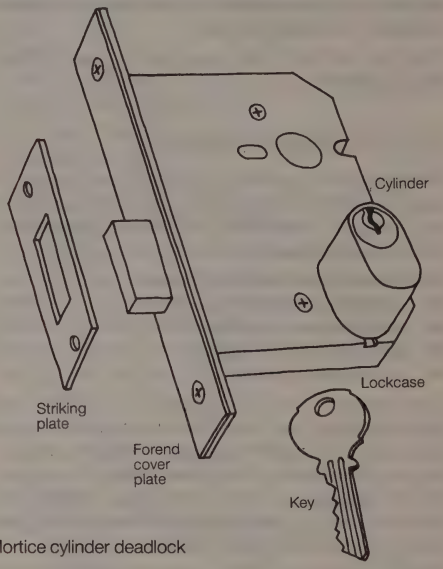


Mortice lever deadlock

Mortice cylinder deadlocks consist essentially of a morticed lock case with forend cover plate, a cylinder in a morticed barrel, a striking plate, and key. The bolt is operated by a cam on the cylinder. The barrel houses a number of pins. Stops on the key align the pins and allow the cylinder with its cam to rotate and move the bolt.

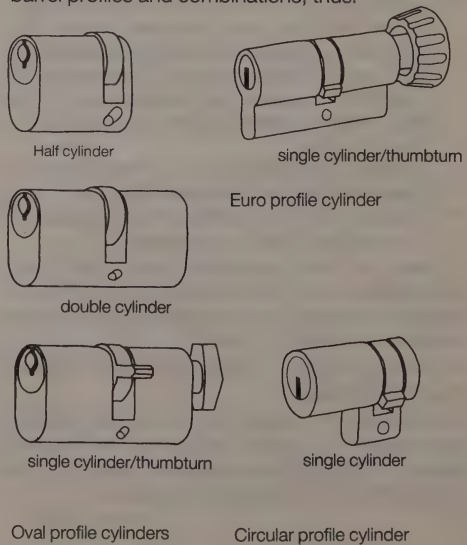
By increasing the number of pins, or by changing the section profile of the key, it is possible to increase the number of variations in key profiles (or 'differs'), and so reduce the risk of casual duplication.

Cylinder locks give excellent key security and the ability to change the cylinder easily.



Mortice cylinder deadlock

The cylinders are available in a number of different barrel profiles and combinations, thus:



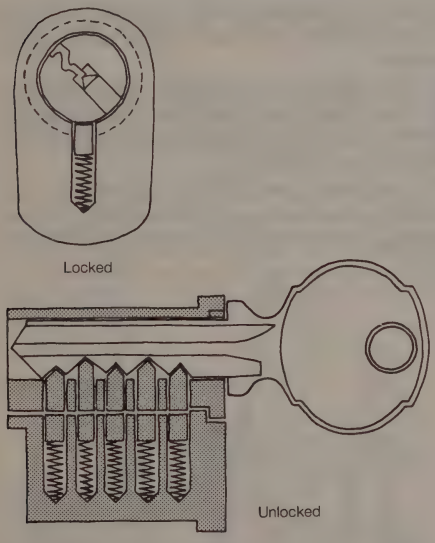
They are operated alternatively by:

- keys from either side of the door ('double cylinder' in previous illustration)
- key from one side of the door and a thumb turn on the other side (('single cylinder/thumb turn' in the previous illustration)
- key from one side of the door only, operating a single cylinder ('single cylinder' in previous illustration).

Cylinders are available in a number of different lengths to suit leaf thicknesses, and the thickness of escutcheons.

Specification of this type of lock should include an escutcheon to mask the joint between the cylinder, and the door face, as face trims normally supplied with cylinder locks are seldom satisfactory. A range of escutcheons, some incorporating pulls is described in 3.6.5.

Keys for cylinder locks are usually grooved along their length and notched along one side. A recent development is a form of cylinder, which contains two banks of pins, and is operated by a stepped key profile. This vastly increases the number of permutations of key shapes available.



Mortice cylinder deadlocks can be used in conjunction with a special box striking plate, which can be electro-mechanically withdrawn. The lock can be operated manually by key or thumb turn, but in addition, control of the keep can be signalled by:

- remote push button,
- local press button,
- magnetic card,
- perforated card.

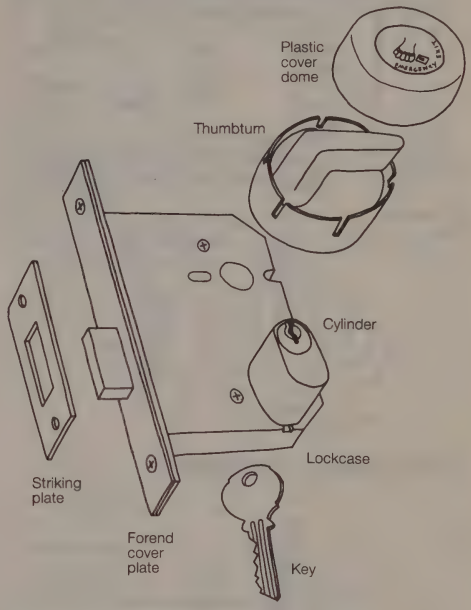
Remote control is usually linked with a telephone and/or monitoring television equipment.

Additional security can be gained by using locks with a "long throw" action.

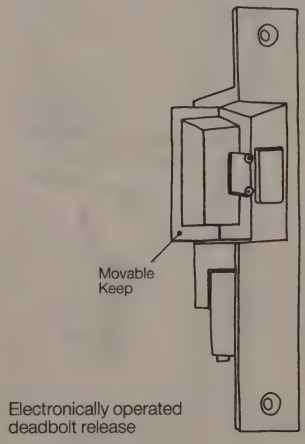
Escape locks

Mortice cylinder deadlocks are also available as escape locks for use in doors which are normally kept locked for security purposes, but must provide a means of withdrawing the bolt for escape purposes in the event of fire. In the version illustrated below, the escape release of the bolt is effected by a thumb turn which is protected against normal misuse by a plastic dome which can be broken off in an emergency. These must be mounted at about 900 above floor level to permit break off action.

Some other patterns of escape locks, often with 'break glass' panels require a large hole through the door which may reduce the resistance of the door below the required period of fire resistance.



Mortice cylinder escape deadlock



Electronically operated deadbolt release

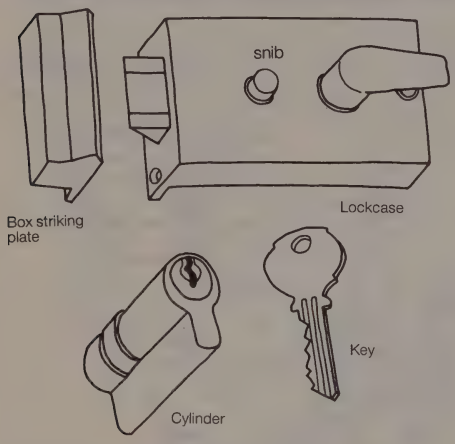
Sprung locks

Sprung locks are locks which lock automatically when the door is closed but require a key to open them.

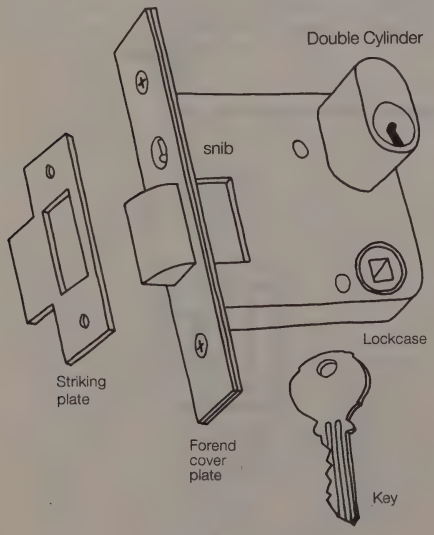
The use of sprung locks in health buildings is limited to face fixed or morticed cylinder night locks or night latches, which are suitable for use in residential or similar accommodation, where:

- keyed access from outside is required to be combined with thumb-turn opening on the inside; or
- keyed access from both sides is required, with latching facility, operated by lever or knob furniture on the inside.

These alternatives are illustrated below:



Surface mounted or rim nightlatch



Mortice cylinder night latch

Generally, wherever keyed locks are required in health buildings, it is recommended that morticed cylinder deadlocks are specified because:

- they are available in a wide range of types and grades,
- more convenient key size,
- the number of differs available is very large,
- they afford good security,
- they are easy to suite and to master,
- cylinders can be readily changed without removing the lock case,
- cylinders and keys can be supplied late in a contract.

Double throw deadlocking gives greater security and should be specified generally, but always in the case of double swing, double doors.

As stated in **2.3.1** it is recommended that locks and latches are specified and fitted as separate items wherever practicable.

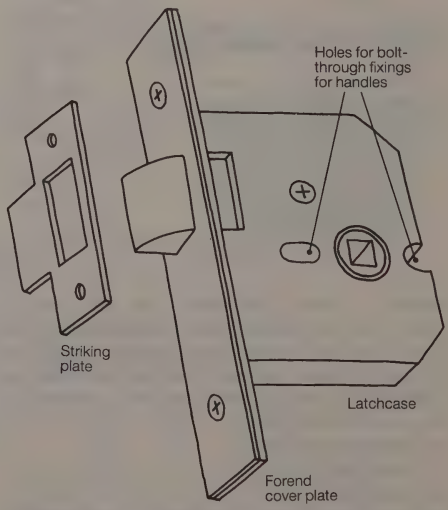
When the selections of locks has been made, the specifications must be completed by decisions on suiting and mastering.

3.5.3 Latches

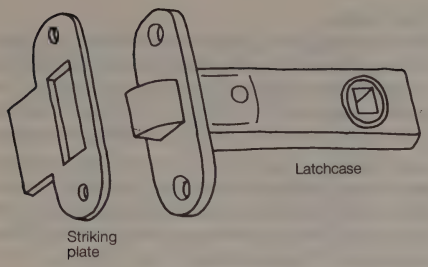
Latches are operated by lever furniture, push pad or bar, to withdraw a bolt which holds a door leaf to a frame.

The latch bolt is usually bevelled for ease of entry to the striking plate, and is essentially spring loaded. Different degrees of springing are available to suit different load conditions.

The two main types of latch operated by lever furniture are mortice and lightweight or tubular latches, the main features of which are illustrated below.



Mortice latch



Lightweight or tubular latch

These two types of latch are available in a number of grades and sizes, the size (or backset) being determined by the dimension from forend to centre line of spindle. This will normally be in the 63 to 75mm range for lever furniture.

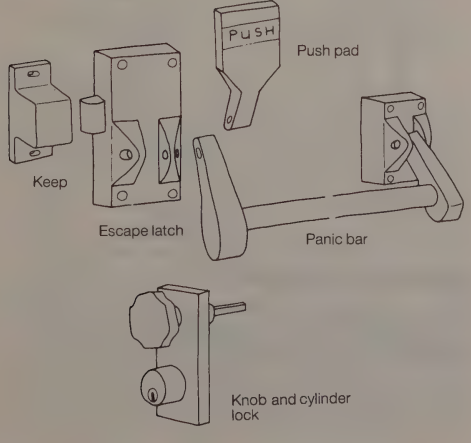
Mortice latches should be specified for most situations in health buildings, except for lighter weight leaves for lighter duty for which the lightweight or tubular type of latch will be appropriate.

For heavier duty situations mortice latches with freeways for bolt-through lever furniture should be specified, ensuring that the position and size of the freeways is compatible with the fixings on the furniture.

For lighter duty situations, furniture set on face plates, which are screwed to the door face may be appropriate, but bolt-through type of fixing will always provide a more robust solution. Where the latter is specified in conjunction with a tubular latch, the through bolts must be vertically disposed to allow the tubular latch to pass between them.

Lighter sprung latches should be operated by sprung handles. Latches for use with unsprung or heavy handles should be fitted with stronger (or duplicate) springs.

Panic latches



BS5725 Type A operated by a horizontal push bar

The preceding illustration shows the main features of this type of latch which is suitable for use on single swing leaves, where it is required to provide means of escape in the event of fire, but access is not required in the opposite direction at all, or is an additional by-pass key operated facility from the reverse side of the door.

They are usually surface mounted (as illustrated) and operated either by the push pad or the panic bar. However, the latter should not be specified where it can be mistakenly used as a grab rail.

BS5725 type B is operated by a horizontal touch bar.

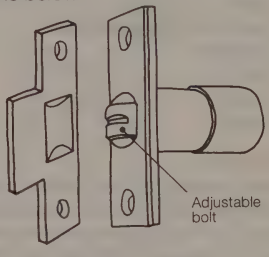
Latches should always be selected with due regard for:

- the function and weight of the leaf
- the type of fixing of lever furniture
- ease of opening.

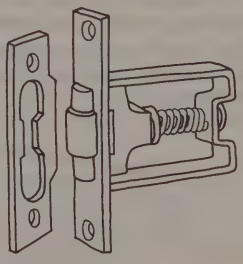
3.5.4 Catches

A catch should hold a door leaf in the closed position, but should release it when the appropriate opening force is applied by the user.

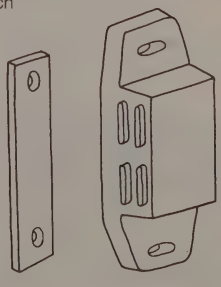
The two main types available are sprung roller catches, and magnetic catches, and these are illustrated in outline below.



Light duty roller catch

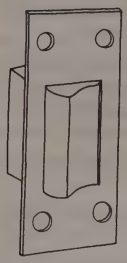


Heavy duty adjustable sprung roller catch



Magnetic catch

These are suitable for holding light and medium weight leaves. The sprung roller type are for morticing into the edge of the leaf, whereas the magnetic type are face fixed.



Emergency release door stop

This is for use on wc and bathroom doors where emergency release may be required.

3.5.5 Bolts

Bolts are devices for securing door leaves in the closed or open position, essentially comprising an unsprung bar or bolt retained by a keep plate or socket.

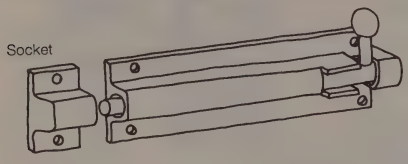
Six types are covered in this section, viz:

- barrel
- flush
- electrically operated bolts
- indicator
- security
- hinge
- panic

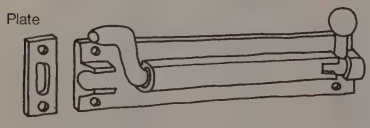
Barrel bolts

These are designed for surface mounting, vertically or horizontally. ircular section bolts are preferred to square or rectangular section because they are easier to operate. They may be straight or necked, the end being retained by a socket or keep plate.

Because they are surface mounted, their security value is limited to the strength of the fixings of the socket or keep.



Straight shoot bolt



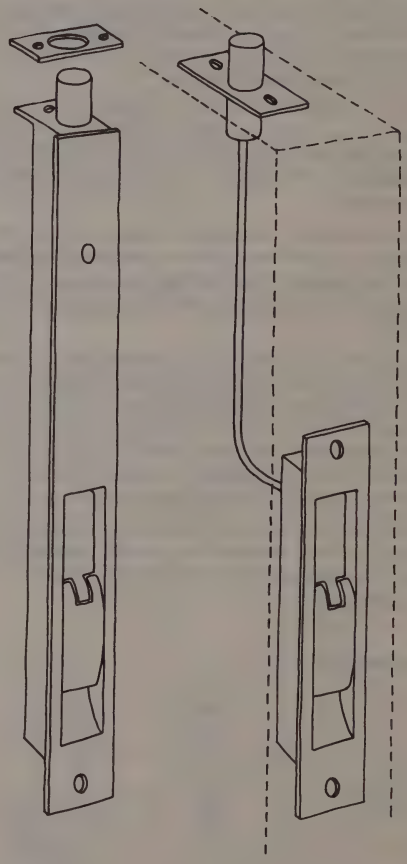
Neck shoot bolt

Flush bolts

These are designed for letting into the face or edge of the door leaf. They are available with slide action or lever action; with a keep plate for setting into the frame, or a socket for letting into the floor; the latter in 'easy clean' pattern, or with a sprung cover plate.

Flush bolts are commonly used for securing the secondary leaf of a pair of leaves, where the primary leaf is held by a latch, with or without a lock. In this application it is recommended that the flush bolts are fitted in the edge, rather than in the face of the leaf, to provide greater security.

This arrangement has been successfully tested and used on CDB Fire resisting doorsets.

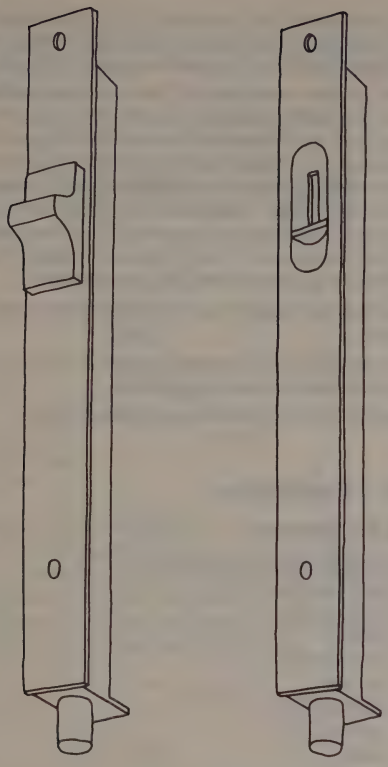


Lever action bolt

Lever action cable operated bolt

Electrically operated bolts

These are available for mounting at head, threshold or meeting stiles of double doors. They are described more fully in 3.6.8.



Slide action bolt

Sunk slide action bolt

Bolts should have encased shoots to ensure ease of operation and freedom from obstruction due to poor morticing of doorleaf. Round section bolts are preferred for ease of engagement with the striking plate. It is essential that bolts are easy to operate.

Dust excluding socket

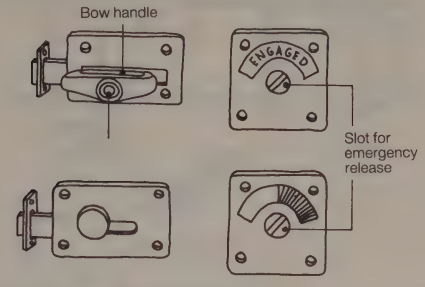
Easy clean socket for wood or concrete

Indicator bolts

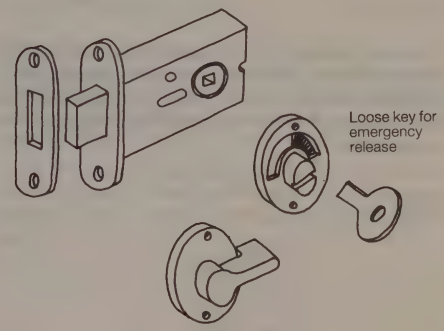
These incorporate an indicator for mounting on the outside of the leaf, which signals when the bolt on the inside is engaged or withdrawn. The signal may be in the form of words (commonly 'engaged' or 'vacant'), or coloured indices (commonly red and green).

These bolts are most commonly specified for wcs and bathrooms. Most of them are of the surface mounted pattern.

They may be operated on the inside by a 'D' shaped handle, or short lever, or a thumb turn. In all cases it must be possible to operate the bolt from the outside for emergency access. This is normally in the form of a deeply slotted head, which can be the outside for emergency access. This is normally in the form of a deeply slotted head, which can be turned by insertion of a coin, key or screwdriver and which should be of sufficiently hard material to resist damage when operated. Alternatively a single cylinder lock with key may be used on mortice pattern indicator bolts.



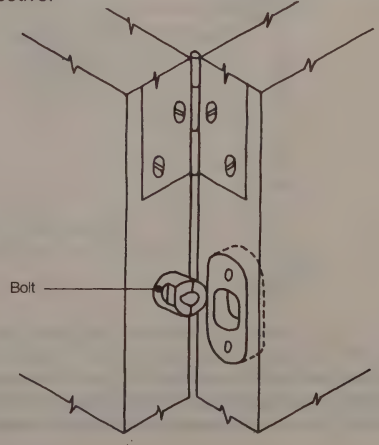
Surface mounted indicator bolts



Mortice indicator bolts

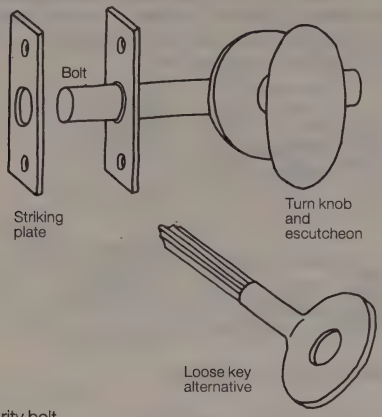
Hinge bolts

These are simple and inexpensive devices for fitting to the hinge side of a leaf to provide greater security. They inhibit unauthorised access through a door even when the hinges have been rendered ineffective.



Security bolts

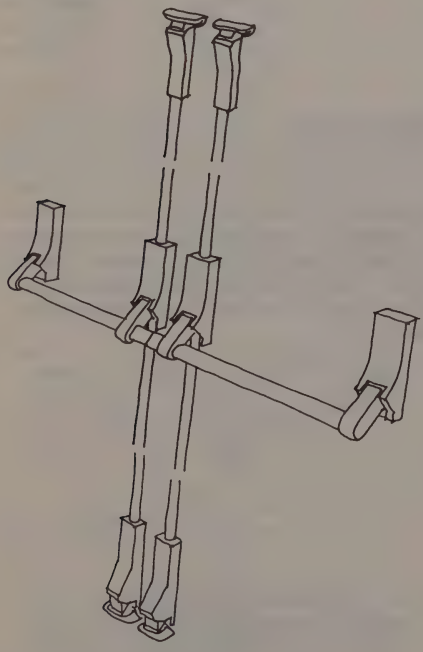
These are small morticed rack bolts operated by thumb turn or loose key.



Security bolt

They are available in two basic sizes. For example the smaller may be used to secure opening lights in a timber window, and the larger to secure a door leaf in its frame at two or three points, in addition to a deadlock.

Panic bolts



Panic bolt

The above illustration shows the main features of this type of bolt, which is suitable for use where it is required to provide means of escape in the event of fire, but access is not required in the opposite direction at all, or is an additional by-pass key operated facility on the reverse side of the door.

They consist essentially of two vertical, surface mounted bolts operating upward to engage in a keep plate at the head of the frame and operating downward to engage in a floor socket. These bolts are engaged or retracted simultaneously through a connecting box operated by downward or horizontal pressure on a horizontal bar. Beacuse a leaf is retained by bolts top and bottom they provide far grater security than a panic latch.

They are available in sets to suit single or double leaves.

They should not be installed in such a manner that they may be mistaken for grab rails.

See BS5725 for specification of these bolts.

3.6 Furniture

3.6.1 General

This functional group includes:

- lever handles
- pull handles
- plates
- escutcheons
- buffers
- limit stays
- holders
- grilles
- seals.

Some of these have considerable influence on the overall appearance of a doorset or door assembly. Perhaps for that reason they are often selected before decisions regarding the basic functions and material specification of the doorset have been made.

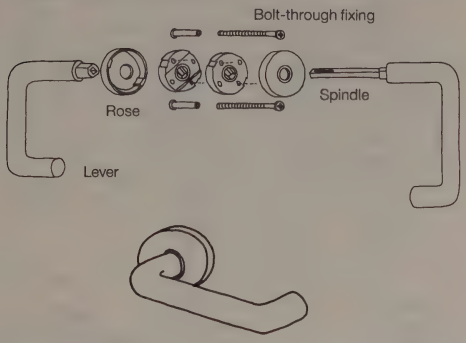
The correct sequence is one in which furniture is selected with full knowledge of:

- location and configuration
- grade
- frequency of use
- method of hanging leaves
- method of operating leaves
- means of securing leaves
- size and weight of leaves
- substrate materials and finishes of leaves and frame
- air transfer requirements
- requirements for attentuation of sound, air, or smoke
- requirements for action of leaves to be limited
- requirements for leaves to be held open.

3.6.2 Lever handles

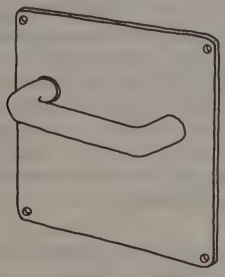
Lever handles should be specified in health buildings in preference to knob furniture, because they are more easily operated by encumbered or incapacitated users.

They are normally supplied in pairs, although single handles (known as a half set) are available for use on cupboard doors. A typical set of lever handles consists of:



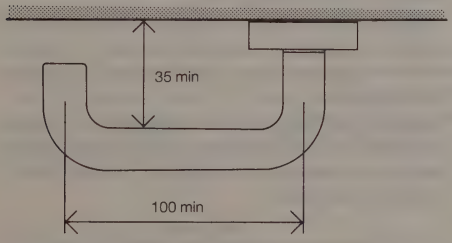
Lever handle
and rose

The rose may incorporate a spring in which case it will have a depth of some 10mm. Some designs incorporate a sprung core with a cover plate which conceals the fixing screws. If the handle is unsprung it can be set onto a flat plate which is drilled to accommodate fixing screws.



Lever handle
and backplate

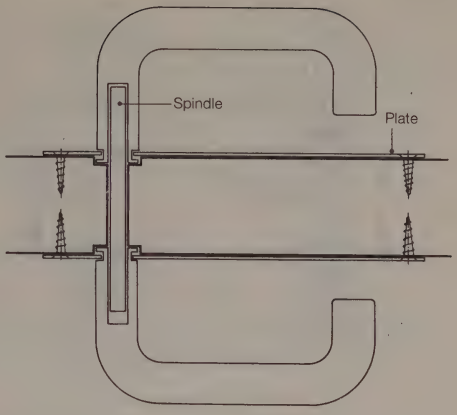
The lever should be of a size sufficient to accommodate a full grip and the end should be turned towards the door face to minimize the risk of accidentally catching on users clothes.



The spindle may be:

- loose ('floating'), or
- fixed.

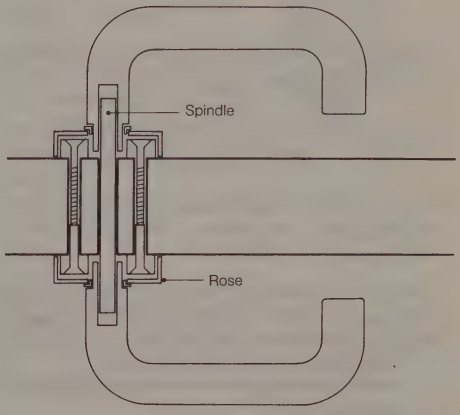
A loose spindle may be used between levers which have back plates screwed to the faces of the leaves thus:



'Floating' loose spindle
Fixed to plates screwed to door

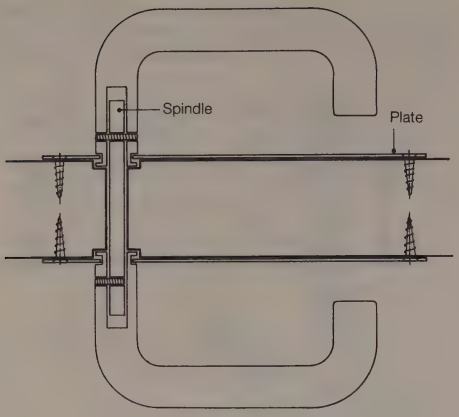
This type transfers the stresses of opening and closing action to the faces of the leaf, and is not recommended for use in health buildings.

A preferred version of the loose spindle, suitable for heavy duty use, is one in which it operates between levers on roses which have bolt-through fixings, thus:



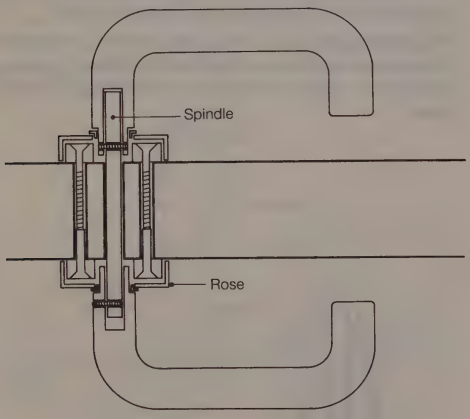
'Floating' loose spindle
Bolt through fixing to door

A fixed spindle is permanently attached to one lever and secured to the other by a grub screw or other proprietary fixing. It is suitable for medium duty use when used with levers having backplates screw-fixed to the faces of the leaf, thus:



Fixed spindle
Fixed to plates screwed to door

Fixed spindles used with levers having roses with bolt-through fixings are recommended for heavy duty use, thus:



Fixed spindle
Bolt-through fixing to door

It should be noted that the bolt through type of fixing (associated with either loose or fixed spindle mounting of lever handles) requires:

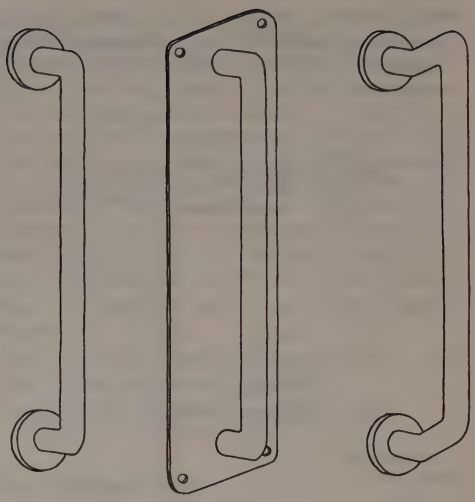
- freeways through a mortice latch, or
- vertical disposition of the through bolts to clear a tubular latch.

Lever handles should comply with the revised edition of BS4951, Classes 2 and 3, ie, medium and heavy duty.

3.6.3 Pull handles

Pull handles consist essentially of a 'D' shaped bar which may be set on a backplate or roses.

They are available in various shapes including straight bar, curved, and cranked (off-set).



Straight pull handle | Straight pull handle on back plate | Cranked pull handle

Pull handles should be fitted only on the pull side of a single swing door with a push plate on the reverse side; this avoids confusion for the user and allows a secure bolt-through fixing to be used.

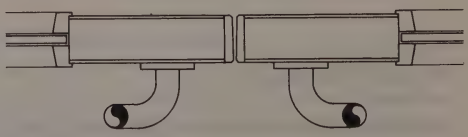
Handles may be attached to a plate or rose which is designed to be screwed to a door facing. Alternatively they may be bolted through from the reverse side of the door, the bolt heads being recessed and covered by a push plate. Bolt-through handles may incorporate a rose at the fixing point and proprietary fixings are available for bolting handles back to back on opposite sides of the door.

As in the case of lever handles, bolt through fixings are recommended for heavy duty situations.

Pull handles for use on doors in health buildings should be of a size and diameter appropriate to the size and weight of the leaf and its degree of use. Most requirements will be met by handles of 200 to 300mm x 19 to 25mm diameter with 40mm clearance from the door face.

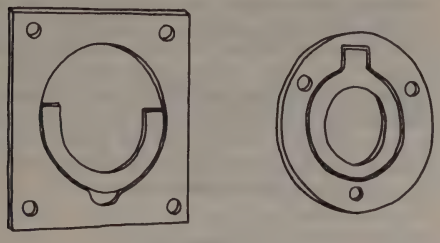
Although usually fitted vertically, pull handles are equally suitable for fixing horizontally, a position which may facilitate use by the physically handicapped.

Cranked pull handles are intended for vertical application in situations (as illustrated below) where the straight pattern of handle would be too close to the edge of the leaf.



Cranked pull handles

In situations where no projection of furniture is practicable, flush ring pulls can be specified. For sliding doors, recessed pulls are available.



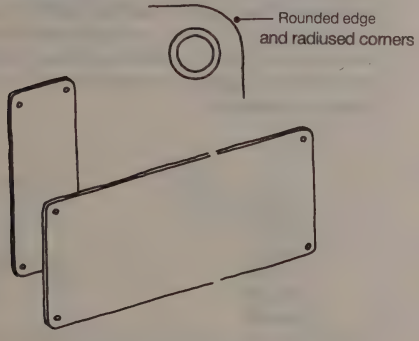
Pull rings

3.6.4 Plates

These may have the function of push plates or protection plates, and should be of the appropriate shape, size, and material.

Soft metals such as aluminium are not suitable for protection plates but may be satisfactory for push plates.

Plates in aluminium and stainless steel are usually drilled for screw fixing, whereas those in plastics are generally fixed with adhesive. High impact PVC is an alternative material.

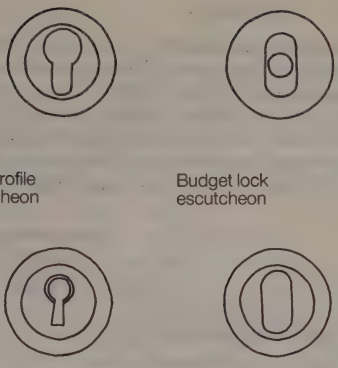


Push and protection plates

All plates should have radiused corners and slightly rounded edges to avoid injury to users. They may be let in flush and returned across the leading edge of a leaf, but this is usually satisfactory only when carried out in the factory.

3.6.5 Escutcheons

These are a form of trim surround used to mask the junction between a door facing and the end of a lock or a lock key hole. They are available in several forms and profiles including covered escutcheons and escutcheons which incorporate a finger pull. They should be used in preference to the lightweight pattern normally supplied as part of a lock set.

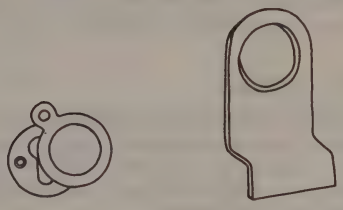


uro profile escutcheon

Budget lock escutcheon

Lever lock escutcheon

Union or oval escutcheon



Covered escutcheon

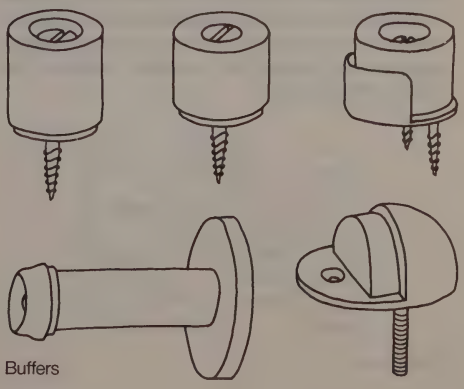
Pull escutcheon

3.6.6 Buffers

Buffers are employed to limit the opening swing of a leaf to protect the doorset and adjoining surfaces against impact damage and strain.

They comprise a buffer component in hard rubber or plastics with metal parts for fixing it to the wall or floor.

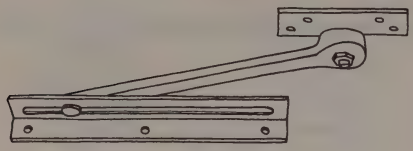
They should be located so as to contact a door leaf at mid height if wall mounted, and near the leading edge.



Buffers

3.6.7 Limit stays

These provide an alternative means of limiting the opening swing of a leaf. They are available in a variety of patterns incorporating sliding or folding arms, with or without friction joints. They are normally fixed to the top of the leaf, and to the head of the frame, and are particularly well suited to controlling leaves subjected to gusting wind.



Limit stay

Concealed types are available for installation into the head of single and double swing leaves. These are not suitable for fire-resisting doors because of the loss of material from morticing.

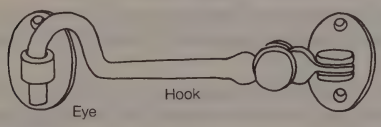
3.6.8 Holders

These are intended to hold a door in the open position. They are available in many different forms ranging from the simplest cabin hook to sophisticated electro-magnetic devices for linking to a detector/alarm system.

The most suitable forms of door holder for use in health buildings are:

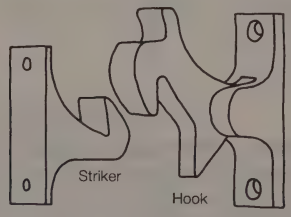
Cabin hooks should be fitted to the opening face of a leaf in line with the furniture to facilitate to positive hooking and unhooking action required.

The eye should be fixed to the leaf and the hook to the wall. The 'Silent' pattern is preferred.



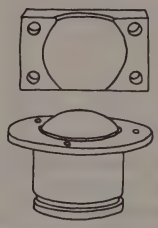
Cabin hook
'Silent' pattern

Gravity hooks should be similarly located and with the striker and hook carefully aligned on leaf and wall face respectively. As its name implies, it engages on contact but requires positive user action to disengage it.



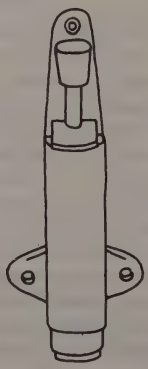
Gravity hook

Adjustable spring ball holders should be located within 150 of the leading edge of the leaf. The holder is let into the floor and screw fixed through the flange plate which is housed flush with the floor surface. The striking plate is housed flush in the bottom edge of the leaf, and must be accurately aligned with the holder, and with sufficient clearance from finished floor level to ensure ease of engagement and disengagement within the limits of the adjustment facility provided in the holder. Generally this type of holder is unsuitable for use in conjunction with soft floor finishes.

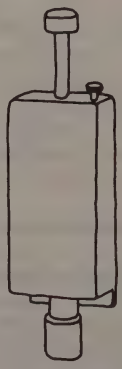


Foot operated holders unlike the others featured in this section can be operated to hold a leaf at any point in its swing.

However if it is not sufficiently retracted when not in use unsightly marking or damage to the floor finish can occur. They should be fitted within 150 of the leading edge of a leaf, and on the closing face where they can be more readily seen. A pattern with electro-magnetic release linked to the alarm system is available.



Foot operated holder



Electrically released holder

Electro-magnetic releases (or detentes) are normally linked to a detector/alarm system. A time delay facility which releases the leaf from the held open position after a set period of time is an option.

The electro-magnet is housed in a BESA box set into an outer case screwed to the wall face, and wired to the system on a low voltage supply. The

contact pad should be located on the opening face of the leaf, so as to give a maximum area of contact in the held open position. Ideally the leaf in its held open position should be parallel to the wall face.

These holders have two important 'fail safe' features:

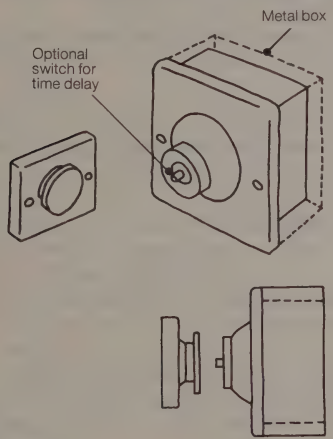
- the leaf is released if the power supply fails
- the leaf can be released manually overriding the electro-magnetic holding device.

This is the only type of holder which should be fitted to fire-resisting or smoke stop doors.

Leaves set on floor springs should have the holder located at or near floor level, while leaves operated by overhead closers should have the device as near to the door head as possible. (See also 3.4 for references to holding with fail safe facility.)

This facility can also be achieved by the use of overhead closers or floor springs with built in electrically activated release mechanism.

The releases should comply with BS5839 Part 3 "Specification for automatic release mechanisms".



Electro-magnetic holder

Electro-magnetic releases in the form of bolts are also available. They may be mounted at the head, threshold or at the meeting stiles of double doors. They can be opened by operating a switch and automatically by activation of the alarm system, or failure of the electrical supply.

3.6.9 Grilles

Where it is absolutely essential to locate air transfer grilles in door leaves, they should be positioned as near floor level as practicable, and in line with any vision panels (see HTM58 Internal doorsets). They should also:

- match adjacent door furniture
- be easy to clean
- prevent through vision
- permit a high percentage of air flow.

Grilles should not be installed in fire-resisting doors even if they are of the intumescent type, as the latter are not activated by the temperature elevls created near floor level in the early stages of a fire, and therefore permit the passage of smoke at that critical stage.

3.6.10 Seals

These should be specified where it is necessary to reduce the passage of:

- sound
- air
- smoke.

They are available in the following materials and forms:

- phosphor bronze strip
- foamed plastic or rubber strip
- plastic or rubber in blade tube, or strip form, with or without an aluminium or plastic housing
- plastic pile or brush in strip form, with or without an aluminium or plastic housing
- magnetic activation.

Intumescent seals must be an integral part of a fire-resisting doorset (see HTM58 Internal doorsets).

Great care is needed to ensure that provision of seals or brushes does not reduce the proper functioning or performance of the doorset. This is particularly important, for example, at the meeting stiles of double doors, or in any situation where the leaves may be inhibited from closing by the seals.

In fire-resisting doors where it is vital that the doors close fully at all times, it may be necessary to select and fit seals which do not require a resistance to closing of more than 12Nm to 17Nm, in order to be able to fit closers of a size which enable the weaker users to open these doors, and yet fully close the doors.

4 Project documentation

4.1 General

This part provides guidance on the communication of design and sepcification decisions relating to ironmongery, to all those concerned with, and responsible for, a building project.

4.2 Schedules

Scheduling of ironmongery should be carried out in parallel with scheduling of doorsets, in the form of a combined schedule (see Appendix B).

This should be so compiled as to be a statement of functional requirements only, leaving all product identifications and manufacturer or merchant references to be dealt with as a separate specification (see 4.3). This enables the functional requirements to stand as a point of reference and not to become confused with the quite separate process of selecting from the many alternative products on the market which can meet those requirements.

When preparing a schedule it is important to refer to the doorset manufacturers product data to establish what ironmongery is provided and fixed by him, as part of the doorset. These items need not be scheduled to be procured by the main contractor. This will normally be limited to hinges, but for certain specialised types of doorset a more comprehensive range of ironmongery may be supplied.

4.3 Specifications

Items of ironmongery included in the schedule will need to be described by manufacturers' names and references in a specification.

The specifier should state if the ironmongery is to be:

- delivered in sets, or
- fixed to leaf or frame in the factory, or
- fixed on site to factory prepared doorsets.

4.4 Bills of quantities

The ironmongery listed on the schedule and specification should be measured in the bills and identified by manufacturers name and catalogue reference. Factory fitted ironmongery purchased by the doorset manufacturer should be described as such and billed separately from site fitted items purchased by the main contractor.

Having identified the items by manufacturers name and reference the choice of supplier may be left to the doorset manufacturer or main contractor as appropriate.

Any special requirements should be stated in the bills eg:

- delivery in batches or sets (see 5.2)
- delivery to a factory for fixing to doorsets (see 2.4)
- suiting of locks (see 2.,5)
- arrangements for handling keys and other security devices (see 6.3)
- factory preparation of doorsets to receive ironmongery on site (see 6.1 and 6.4).

5 Procurement

5.1 General

On any project the ironmongery will be obtained from the following suppliers:

- Merchants who may be:
  - architectural ironmongers or
  - hardware factors or
  - builders merchants.

Any one of these may hold stocks, distribute to builders, and employ technical representatives.

Some merchants have exclusive marketing arrangements for one or more components. Others market a range of components which they obtain from a variety of sources.

Many merchants offer components labelled or identified with their own name, The same goods are frequently available from other sources under a different reference.

Many merchants are members of the Guild of Architectural Ironmongers. The Guild requires its members to employ trained technical representatives. These may also be members of the Institute of Architectural Ironmongers.

- Manufacturers

No manufacturer produces a complete range of components. Some specialise in the production of one item, other produce only locks and latches or only furniture.

A few manufacturers market direct and maintain their own technical representatives. Others sell their products through merchants.

Manufacturing interests in the U.K. are represented by the Association of Builders Hardware Manufacturers.

Suppliers offering products other than to U.K. standards should be required to produce evidence that their products are at least equal to these standards.

5.2 Sets of ironmongery

Arrangements can be made for ironmongery to be packaged, suitably labelled and delivered in sets.

5.3 Ordering

Certain selected items such as:

- protection plates
- suited locks
- grab rails

may not be held in stock by the merchant or may be manufactured to order which will involve an extended delivery period. It is essential therefore that such time factors are known and allowed for in the building programme.

6 Site practice

6.1 General

Site supervising staff must ensure that all items delivered are in accordance with the schedule and specification; and are fixed in accordance with the manufacturers instructions.

All items should be eased and adjusted before handover.

Recommended fixing positions for ironmongery on a doorset or door assembly are shown in Appendix A.

6.2 Product data

Site staff should be provided with the appropriate product information to enable them to carry out their duties effectively. It is suggested that this takes the form of copies of illustrations and data of selected products taken from the manufacturers or merchants catalogues, together with the schedule of products.

It is good practice for a sample board to be made up and kept on site, as an effective way of checking delivered items of ironmongery.

6.3 Custody of security devices

The receipt, recording, storage and handling of keys should be closely controlled especially where mastered locks are specified.

In order to avoid unauthorised duplication, special security devices, eg master keys, entry cards etc., should be obtained direct from the merchant supplying the device, and retained by a named person until hand-over.

6.4 Morticing

All morticing of doors and frames should be done accurately to avoid over-sized mortices which will result in less secure fixings and, in the case of fire-resisting doorsets, may invalidate their performance. Machine morticing is therefore preferred to hand morticing.

Items morticed into one hour fire-resisting doorsets must be protected by intumescent materials. For locks and latches this protection should consist of intumescent paste or, a sheet of intumescent material on each side of the lock or latch case, Any other morticed items should be painted with intumescent paint before being fitted (see also 2,4 and 6.1) or bedded in intumescent paste.

7 Maintenance

7.1 Project maintenance manual

A project maintenance manual should be compiled by the project architect, and handed to the maintenance staff immediately following practical completion of the works. This should include the following:

- identification of manufacturer of each component,
- manufacturer's or merchant's catalogue reference for each component,
- any special finishes or colours, if not part of above reference,
- details of intumescent materials used in association with ironmongery fited to fire-resisting doorsets,
- instructions for cleaning and maintenace.

The Manual should include manufacturers literature where appropriate.

7.2 Planned maintenance

Schedules of planned maintenance shoulde include:

- periodic checking of fixing screws for all components,
- the correct adjustment of closers, springs, pivots and roller bolts,
- lubrication and cleaning of components as described in 7.3.

The relevant section of Estmancode should be referred to for more specific recommendations.

Components linked to the fire alarm system should be tested as part of the regular alarm test procedures.

Maintenance contracts are available to cover such items as floor springs and automatic door controls.

It is useful for maintenance staff to keep a small stock of spare lock cylinders and keys for quick replacement purposes.

7.3 Lubrication and cleaning

Operating components, such as closers and floor springs, are pre-lubricated or immersed in oil and should give long service without attention.

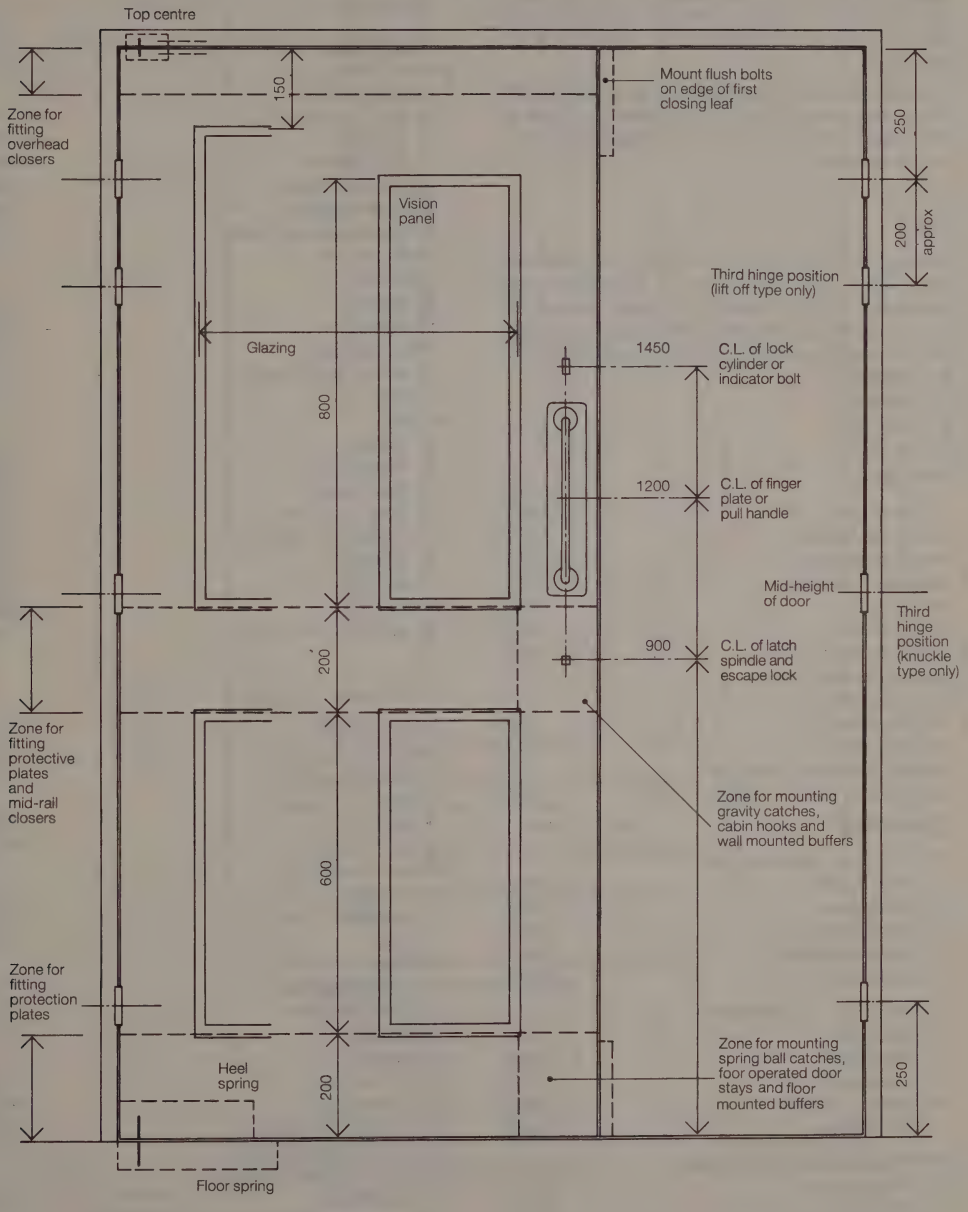
Sliding bolts, hinges and latches, require occasional lubrication with light oil.

Lever furniture should not require lubrication as contact faces are usually non-metallic and are designed for long service without attention.

Exposed finishes should be washed with warm water and a mild detergent to maintain their appearance.

Appendices

A Recommended fixing positions for ironmongery



Note: Necessary framings and blockings to receive ironmongery are shown in HTM58 Internal doorsets.

B Schedules and codes

Schedule

The preparation of a combined doorset and ironmongery schedule for each project is strongly recommended. A model schedule is given on page 35 (see also HTM58 Internal doorsets).

As a first step it is necessary to identify each doorway by a unique reference which can be shown on the layout drawings and entered on the schedule.

The schedule can then be used to enter specific information which can be progressively refined as the project proceeds from initial design to project documentation.

Code

Having coded the doorsets in accordance with the mnemonic code described in HTM58 Internal doorsets, the combined schedule should be completed by coding the ironmongery by the four functional groups referred to in 2.2 as follows:

- hanging
- operating
- securing
- furniture

Hanging

Lift off hinges	HH1
Loose pin hinges	HH2
Fixed pin hinges	HH3
Ball bearing hinges	HH4
Rising butts	HH5
Falling butts	HH6
Single action pivots	HP1
Double action pivots	HP2
Gravity pivots:	
• direct action	HP3
• hold open	HP4
Sliding door gear – top hung	HS1
Sliding door gear – bottom bearing	HS2

Operating

Floor springs - single action:	
• direct action	OF1
• stand open	OF1S
• delayed action	OF1D
• alarm activiated	OF1A
• back check	OF1B
Floor springs - double action:	
• direct action	OF2
• stand open	OF2S
• delayed action	OF2D
• alarm activated	OF2A
• back check	OF2B
Overhead closers – horizontal:	
• direct action	OO1
• stand open	OO1S
• delayed action	OO1D
• alarm activated	OO1A
• back check	OO1B
Overhead closer – vertical	002
Middle rail closers	OM1
Automatic door controls:	
• swing action – single acting	OA1
• swing action – double acting	OA2
• sliding action – single acting	OA3
• sliding action – double acting	OA4

Securing

Budget locks	SR1
Lever locks	SL0
Cylinder locks:	
• key/thumb turn	SK1
• key/key	SK2
• half cylinder	SK3
• escape device	SK4
• high security	SK5
• mastered add suffix	-M
Night latches	SN1
Latches:	
• general	SL1
• light duty	SL2
Panic latches	SP1
• with key add suffix	–K
Catches	SC1
Bolts:	
• barrel	SB1
• flush, slide	SB2
• flush, lever	SB3
• indicator – rim	SB4
• indicator – mortice	SB5
• hinge	SB6
• mortice	SB7
• panic	SB8
• with key add suffix	–K

Furniture

Lever handles	FL1
Pull handles	FO1
Flush ring pulls	FR1
Plates:	
• push	FP1
• protection	FP2
Escutcheons:	
• keyhole	FE1
• covered	FE2
• pulls	FE3
Buffers:	
• wall mounted	FB1
• floor mounted	FB2
Limit stay	FS1
Door holders:	
• cabin hook	FH1
• gravity hook	FH2
• spring ball catch	FH3
• foot operated stay	FH4
Electro-magnetic detentes:	
• automatic	FH5
• with additional time delay add suffix	–D
Grilles:	
• air transfer in doors	GD1
• fire dampers in partitions	GP1

Model doorset and ironmongery schedule

1 Room/Area Number/Name	2 Opening no./ Doorset ref.	3 Partition or wall thickness	Doorset							Ironmongery				
			4	5	6	7	8	9	10	11 Hanging	12 Operating	13 Securing	14 Furniture	15 Special equipment
317 6 bed room	3(32)110	100								–	OF	SK	FP	XP

Notes

1 Refer to general arrangement drawings for location information

2 All openings 2100 co-ordinating height unless noted

3 Partition or wall thickness to be stated

4, 5, 6, 7, 8, 9, 10, refer to HTM58, Internal doorsets

11, 12, 13, 14, refer to page 34 for a suggested method of coding.

15. Prefix with an X means any coding included for special requirements

This schedule should be read in conjunction with project drawings and specification.

Title Panel

Appendix C

Operating forces of door closers

General

Overhead closers and floor springs consist of an oil filled case containing a spring(s) which is compressed or wound up during the opening movement of the door and stores the energy thus applied. On release the spring returns the door to the closed position.

The closing action is controlled by a piston sliding in a cylinder with an adjustable valve permitting a controlled escape of oil, giving varying closing speeds.

Overhead closers

To overcome a spring latch or draught seal most overhead closers allow the door to speed up during the final few degrees of closing. This latching action can be adjusted or overridden by a valve within the cylinder or by the design of the arms.

A limited form of power adjustment can be achieved in some overhead closers by the use of an asymetmetrical bracket securing the arms to the door frame. The arm connecting pin is positioned out of centre between the fixing screws, thus if the bracket is reversed, the distance between the closer spindle and arm connecting pin is reduced. This gives a modest increase in power through the final few degrees of the closing action.

Some closers fixed on the push side of the door suffer a power loss compared with those on the more normal pull side. This loss may be as much as 30% and is due to poor mechanical advantage and the fact that the arm and spindle move through a smaller arc relative to the door opening angle, causing the spring to achieve less compression. Where closers have to be fixed on the push side of a door and it is important to maintain the power, a larger size should be used.

Floor springs

A latching action is available only in a few special versions of floor springs.

Many floor springs align the door precisely in the closed position and this facility should be specified. This is an essential requirement for double swing doors and for fire-resisting and smoke containment doors.

Selection guidance

The ability of the closer to exert sufficient force to withstand air pressure whether generated by wind, by fire or by air conditioning and extraction systems must be considered in relation to the ability of users to operate the door. Advice should be sought from closer manufacturers where doors in health buildings have to withstand high air pressures. The wrong component incorrectly installed may seriously affect the safety and confort of users and can result in damage to both the door and closer.

The closers will also have to overcome friction in hinges, resistance of edge seals and any latch bolts fitted.

The resistance due to the friction of hinges has been shown to be within a range of 2Nm to 9Nm. The BS for hinges (under preparation 1989) states a figure of 3Nm.

For fire doors, it is recommended that friction for a set of 3 hinges should not exceed 2Nm.

The resistance due to edge seals can vary widely, a range of 12Nm to 17Nm should be aimed for.

The resistance of latch bolts has been shown to be in the region of 5Nm, and this is included in the revision of BS5872, under preparation in 1989.

The following information will be required when selecting and procuring door closers:

- door size
- air pressure
- type of closer
- configuration of door
- user requirements
- type of hinges, pivots
- type of seals

The main consideration in the selection of closers is that the operation of doors must be possible by the weaker groups of users, whilst the components must be sufficiently durable to withstand use by the stronger groups and forces such as air pressure and impact from equipment.

The weaker groups of users are:

- females of 5 to 12 years of age.
  These can exert push or pull forces of 20N on doors fitted with knob furniture and 45N on doors fitted with lever handles.
- females over 60 years of age
  These cna exert forces of 25N on doors fitted with knob furniture and 65N on doors fitted with lever handles.

Installation

Overhead closers should be fixed strictly in accordance with the manufacturers instructions, particular attention being paid to the fixing position.

They are normally mounted 150mm to 300mm from the hinge to the pinion when on the pull side of the door which permits opening angles of up to 180° to be achieved with some closers. In others the mounting position has to be varied to suit the opening angle required, eg an opening angle of 100° may mean a mounting position of say 250mm from the hinge compared with 150mm to achieve a 180° opening angle. In the latter case projecting hinges may be required to reduce the risk of the closer striking the wall when the door is fully open.

When a closer is fitted nearer the hinge the closer's power will be reduced. This phenomenon can be used to reduce opening resistance to suit user requirements.

Efficiency of door closers

Because of inherent friction in the mechanism and in any arms and hinges, no closer is capable of closing a door by a force equal to that applied in its opening.

The efficiency of closers is measured as a percentage and is calculated as follows:

$$\text{Efficiency} = \frac{\text{closing force}}{\text{opening force}} \times 100$$

In health buildings closers with efficiencies in the range of 50% to 70% should be specified.

Operating forces

BS6459 lays down basic criteria for closers including levels of efficiency. These levels allow for minor manufacturing tolerances that occur in practice and many closers will exceed these minimum figures.

Closers are manufactured in a range of sizes with varying spring strengths to suit varying door leaf widths and weights (see table below). In addition some closers are available with adjustable spring strengths and some floor springs can have the springs changed in situ.

By combining Tables 1 and 2 and paragraph 4 of BS6459 Part 1 the following data can be derived:

closer size number	maximum door leaf width in mm	minimum closing moment at 2° opening in Nm	minimum efficiency %
2	830	10	40
3	930	17	50
4	1030	27	60
5	1130	37	60
6	1330	48	60

Closing moment (or torque) represents a force acting at a lever arm. The minimum closing moment set out in the above table shows forces in Newtons acting at a lever arm of one metre.

— closing moment = closing force x lever arm
Additional data can be calculated.

— closing force at leading edge of door = closing moment ÷ width of door.

The opening moment being a product of the closing moment and the efficiency may be calculated

— Opening moment = closing moment x % efficiency

Additional data on opening forces can also be calculated:

— opening force at leading edge = opening moment ÷ door width

— opening force at handle position = opening moment ÷ handle to hinge dimension

Air pressure on a door, acting through the centre of the door can be calculated as a force acting at the leading edge of the door:

— force at leading edge =
$$\frac{\text{Area x pressure}}{2}$$

Example

Area of door – 930 x 2050 = 1.9m^2
Pressure – 30pa (Pa = N/m^2)
Total force on door = 30 x 1.9 = 57N

Force at leading edge =

$$\frac{1.9 \times 30}{2} = \frac{57}{2} = 28.5\text{N}$$

If this force is acting to push the door open, then the closer will have to overcome the force. A size No.4 closer has a closing moment of 27N, therefore closing force at leading edge =

$$\frac{27}{.93} = 29.03\text{N}$$

This does not allow enough strength to overcome hinges, seals etc., so a size No.5 is required.

Closer size No.5 has a closing moment of 37N, therefore closing force at leading edge =

$$\frac{37}{.93} = 39.78\text{N}$$

The users will have to overcome this closingf force of the door to open it.
opening moment = closing moment x % efficiency

$$= 37 \times \frac{100}{60} = 61.66\text{N}$$

Opening force at handle
= opening moment ÷ handle to hinge dimension

$$= \frac{61.66}{.85} = 72.54\text{N}$$

If the air pressure is acting to push the door closed, then the users may have to overcome both the air pressure and closing forces.

Appendix D

Specification for hinges

Part 1 Performance requirements

1. General

1.1 Hinges should suit door leaves between 40mm and 54mm thick.

1.2 Hinges should be supplied with all necessary fixing screws.

1.3 Hinges for fire doors shall comply with Building Regulations.

2. Range

A range of hinges is required, classified according to the weight of the door, as follows:–

Hinge Class	Weight of door not exceeding
A	110 kilograms
B	80 kilograms
C	60 kilograms
D	40 kilograms

The minimum frequency of operation required is 500,000 cycles.

Note: The maximum door weights listed are based on the use of three hinges per door.

3. Designs

The requirement is for lift-off or loose pin hinges in order to facilitate quick and easy installation and removal of doors on site.

4. Materials and finishes

4.1 The metals used for the principal components of hinges such as leaves, knuckles, barrels and pins may be ferrous or non-ferrous without restriction on the methods of fabrication. The use of plastics materials for such components is prohibnited, but plastics or other non-metallic materials may be used for ancillary components such as washers, bushes or ferrules, or for the corrosion protection of metal components.

4.2 No special surface finish or corrosion protection is required for hinges which are intended to be painted in situ after fitting during normal decoration and re-decoration of the building.

4.3 Hinges not intended to be painted in situ shall have their corrosion resistance assessed by neutral salt spray testing. Hinges to be used internally shall be subjected to 24 hours exposure and hinges to be used externally shall be subjected to 96 hours exposure to neutral salt spray testing.

5. Assessment

5.1 Until such time as the revision of BS1227 has been agreed and published hinges will be required to meet the acceptance criteria set out in Part 2 of this Appendix.

5.2 After such publication those tests which are evaluating the same parameters shall be carried out in accordance with the relevant British Standard. All other parameters shall be tested and assessed to the satisfaction of the supervising officer.

Appendix D

Specification for hinges

Part 2 Test and assessment

1. Test apparatus

The test apparatus shall simulate a doorset. It shall consist of a rigid outer frame which supports, through the hinge under test and a lower bearing, interchangeable test leaves. It shall comply with paragraphs below.

1.1 The outer frame shall be capable of supporting, through the hinge under test, the test leaf specified in Table A for the class of hinge being tested. It shall also support the overload test specified in Table B. The attitude of the frame, that controls the axis of rotation of the hinge under test, shall remain vertical within a tolerance of angularity of 1mm throughout the test procedures specified in cluses 2.3, 2.5, 2.6 and 2.7.

1.2 The hinger under test shall be the upper pivot of the test leaf. The lower bearing shall provide horizontal restraint only, allowing any vertical movement, as the hinge under test wears, to be without restriction. The lower bearing shall have a resistance to rotation not greater than 1Nm.

1.3 The test frame shall have a steel mounting plate of sufficient size and rigidity to support the hinge under test. The vertical positioning of the mounting plate shall provide a distance between the centre of the hinge under test and the lower bearing of 1540 ± 5mm. The attitude of the mounting plate as it affects the hinge under test shall remain vertical within a tolerance of angularity of 0.1mm diameter throughout the test procedure specified in clause 2.3, 2.5, 2.6 and 2.7.

1.4 The test leaves shall be of sufficient rigidity to support the mass required in the overload test specified in Table B. The attitude of the leaf that controls the axis of rotation shall remain true within a tolerance of angularity of 1mm throughout the test procedure specified in clauses 2.3, 2.5, 2.6 and 2.7.

1.5 The test leaf shall have a steel mounting plate that corresponds to the mounting plate on the frame to support the hinge under test. The lower bearing shall be attached to the leaf. The horizontal positions of the mounting plate on the leaf, the mounting plate on the frame and the lower bearing shall provide an axis of rotation, relative to the centre of gravity of the test leaf, that is the same ± 1mm as that which would be found if the hinge were mounted on a 45mm thich door leaf, or on a door whose thickness is specified by the manufacturer of the hinge under test, if different. The centre of gravity of the test leaf shall be at right angles to a point on the plane of the test leaf which is 463 ±10mm from the axis of rotation and equidistant from the centre of the hinge under test and the lower bearing ±10mm.

1.6 A suitable apparatus shall be provided to cycle the hinged leaf smoothly through 95 +5 –0 at a speed of between 4 and 6 cycles per minute (see clause 2.7). The opening and closing forces shall be applied and maintained at 90 ±5 to the plane of the hinged leaf 425 ±75mm below the test hinge centre and at least 400mm from the vertical axis of rotation.

1.7 Datums shall be provided to facilitate the measurement of the vertical and horizontal movement of the test leaf relative to outer frame at a point 170 ±5mm above the centre of rotation of the hinge under test.

2. Test procedure

2.0 The testing authority shall be 'NAMAS' certified or be approved by the supervising officer.

2.1 Test sample

Sample size – the sample size shall be sixteen hinges for types not required to be corrosion tested or twenty two hinges for types subject to corrosion testing.

2.1.1 Sixteen ot twenty two hinges as appropriate, representative of one design and classification, shall be selected at random from a batch or batches of continuous production by, or to the satisfaction of, the Testing Authority. The batch/lot traceability shall be recorded and submitted with each item for test.

2.1.2 The manufacturer, type, classification and serial/reference number of the hinges shall be recorded. The hionges shall be marked non-destructively and indelibly with a unique indentification.

2.1.3 The Testing Authority shall measure and record the principal dimensions of the hinges and shall verify from manufacturer's drawings, literature or representative samples that these dimensions are within quoted manufactuer's tolerances.

2.1.4 Three hinges shall be subjected successively to the Initial Measurements (2.3), Load-Deformation test (2.5) and Overload test (2.6).

2.1.5 Three new hinges shall be subjected to the Endurance test (2.7). Three more new hinges shall be subjected to the Corrosion test (2.8), if applicable.

2.1.6 The balance of the hinges submitted for test shall be put into safe keeping and be available for re-testing if necessary (2.9).

2.2 Ambient temperature

The temperature in the laboratory shall be maintained at 20°C ±5°C throughout the period of testing.

2.3 Initial measurements

Three hinges of each type shall be submitted to the following measurement procedure.

2.3.1 Mount the hinge under test on the test rig specified in 1 above using well fitting bolts and nuts tightened to a torque of 2 +0.1 –0Nm.

2.3.2 Load the test hinge to an initial weight which is equal to that specified in Table A for the class of hinge under test.

2.3.3 Rotate the hinged leaf through 95 degrees +5 degrees –0 degrees for twenty cycles without shock.

2.3.4 Measure and record the initial lateral and vertical gaps between the hinged leaf and the datum surfaces.

2.3.5 Apply without shock a horizontal force towards the lateral datum surface on the fixed frame sufficient to take up the lateral horizontal free movement between the components of the hinge plus 25 ±5N. Measure and record the lateral gap between the hinged leaf and datum surface. The maximum permissible initial horizontal free movement shall be 0.2mm. Remove the horizontal force.

2.3.6 For hinges other than lift off types apply without shock a vertical lifting force equivalent to the weight of the hinged leaf plus 25 ±5N as near as practicable to the axis of the hinge in order to take up the initial vertical free movement between the components of the hinge. Measure and record the vertical gap between the hinged leaf and the datum surface. The maximum permissible initial free movement shall be 0.4mm. Remove the vertical force.

2.4 Static load tests

These tests continue with the same hinge after completion of the tests in 2.3. The maximum prescribed loads for each Class shall be as listed in Table B.

2.5 Load-Deformation test

2.5.1 Apply a further load without shock as near as practicable to the geometrical centre of gravity of the hinged leaf. The magnitude of the additional load shall be such that the total of test leaf plus load is equal to the maximum test load specified in Table B for the hinge Class.

2.5.2 Swing the hinged leaf through twenty cycles as in 2.3.3. Measure and record the lateral and vertical gaps.

2.5.3 Remove the load without shock. Allow one minute minimum to two minutes maximum, then swing the hinged leaf five times as in 2.3.3. Measure and record the lateral and vertical gaps.

2.5.4 Note if any visible cracks or other deformation of the hinge have occurred, and note any change in the functional movement of the hinge.

2.5.5 Acceptance criteria.
All three hinges tested shall pass each of the following criteria:–

(i) The lateral displacement under load shall be 2mm maximum.
(ii) The vertical displacement under load shall be 4mm maximum.
(iii) The lateral and vertical residual displacements after unloading shall be within the shaded area of Figure 1.
(iv) There shall be no visible cracking or breakage of any component.

2.6 Overload test

2.6.1 After completion of the test in 2.5 apply to the same hinge without shock the overload prescribed in Table B for the hinge Class as near as practicable to the geometrical centre of gravity of the hinged leaf.

2.6.2 Swing the hinged leaf through five cycles as in 2.3.3.

2.6.3 Sustain the load for one minute minimum to two minutes maximum after clause 2.6.2, and then unload.

2.6.4 Examine the hinge for visible cracks, deformation or breakage of any component and record the results.

2.6.5 Acceptance criteria. All three hinges tested shall comply with the following criteria:–

(i) There shall be no breakage of any hinge leaf, knuckle, barrel or pin.
(ii) The test leaf shall remain connected to the frame even though the hinge may have been rendered inoperable.

2.7 Endurance test

2.7.1 Three new hinges not subjected to the previous tests shall be subjected to the following endurance test. They shall be tested as supplied without additional lubrication.

2.7.2 The test leaf weights and numbers of cycles for each Class shall be as listed in Table A.

2.7.3 Mount the hinge under test as specified in 2.3.1. Load the test leaf so that the total load is equal to the required test load as specified in Table A.

2.7.4 Operate the hinged leaf through 95 degrees +5 degrees –0 degrees for twenty cycles without shock.

2.7.5 Measure and record the initial horizontal and vertical gaps between the hinged leaf and the datum surfaces.

2.7.6 Operate the hinged leaf through 95 degrees +5 degrees –0 degrees for 4000 +1% –0 cycles.

2.7.7 Each cycle shall consist of an opening operation taking 3 to 5 seconds, a closing operation taking 3 to 5 seconds and a dwell period of 4 to 5 seconds.

2.7.8 Measure and record the torque required to initiate movement of the hinged leaf at opening angles of 0, 30, 60 and 90 +5. The maximum frictional torque shall be 3Nm.

2.7.9 Operate the hinged leaf through 95 degrees +5 degrees –0 degrees for the additional number of cycles necessary to bring the total number of cycles to that specified in 2.7.2.

2.7.10 Repeat the measurement of frictional torque and horizontal and vertical gaps. The maximum frictional torque shall be 3Nm.

2.7.11 If the fritctional torque exceeds 3Nm then the following procedure shall be followed to ensure that the torque of the lower pivot bearing has remained below 1Nm.

Remove the test hinge and replace with a load bearing unit of low frictional characteristics and remeasure the frictional torque of the hinged leaf. If this repeated measurement is less than 1Nm then the original torque value should be reported as the frictional torque exhibited by the hinge.

If, however, the repeated measurement exceeds 1Nm then renew the lower pivot bearing so that the frictional torque of the hinged leaf is less than 1Nm. Replace the top load bearing unit with the test hinge and repeat the frictional torque measurement. This value shall then be quoted as the frictional torque exhibited by the hinge.

2.7.12 The measurement of horizontal and vertical movement may additionally be taken at intervals or constantly be monitored throughout the endurance test.

2.7.13 Acceptance criteria:–

All three hinges tested shall pass each of the following criteria:–

(i) The amounts of lateral and vertical wear measured as displacements of the datum surfaces shall be within the shaded area of Figure 2.

(ii) The maximum permissible frictional torque measured at 4000 cycles and at the end of the test shall be 3Nm.

2.8 Corrosion test

Hinges which are supplied in self colour mill finish for subsequent corrosion protection in situ (eg by painting) shall not be subject to corrosion testing.

2.8.1 Hinges which are intended to be used without further corrosion protection in situ shall be subjected to neutral salt spray testing in accordance with BS5466: Part 1: 1977.

2.8.2 Three hinges shall be tested. The exposure periods shall be 24 hours –0 +½ hour for hinges intended for internal use and 96 hours –0 +½ hour for hinges intended for external use.

2.8.3 Acceptance criterion. There shall be no corrosion of the base metal on significant surfaces visible to normal or corrected vision.

Note: Staining or discolouration of an applied surface treatment is acceptable and should not be confused with corrosion of the base metal.

2.8.4 A significant surface is any surface which is visible when the hinge is installed and which is essential to the appearance, function or serviceability of the hinge.

2.9 Re-testing

2.9.1 Initial measurements and static load tests.
If any of the sample of three hinges tested fails to pass any one of the acceptance criteria then a further sample of six hinges shall be subjected to the test in which failure occurred. If all six hinges re-tested then meet the acceptance criteria the first failure shall be ignored.

If any of the six hinges re-tested fails to meet all of the acceptance criteria no further re-testing shall be allowed.

2.9.2 Endurance test and corrosion test (if applicable).
If any of the sample of three hinges tested fails to meet the acceptance criteria then a further sample of three hinges shall be submitted to the test in which failure occurred.

If all three hinges then meet the acceptance criteria the first failure shall be ignored.

If any of the three hinges re-tested fails to meet the acceptance criteria no further testing shall be allowed.

2.10 Final report

The final report shall include comparative photographic evidence of an untested hinge and hinges which have been subjected to each of the test procedures, together with a subjective report on the results.

Table A Endurance test

Class	Test leaf weight +0.5 –0 kgs	Number of cycles +1% –0
A	110	500,000
B	80	500,000
C	60	500,000
D	40	500,000

Table B Static load tests

Class	Load deformation test +0.5 –0 kgs	Overload test +0.5 –0 kgs	Maximum test load
A	220	330	
B	160	240	
C	120	180	
D	80	120	

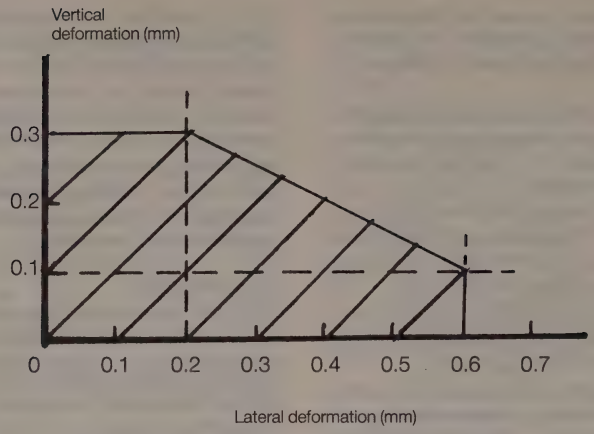


Fig. 1 Limits of allowable deformation in static load tests

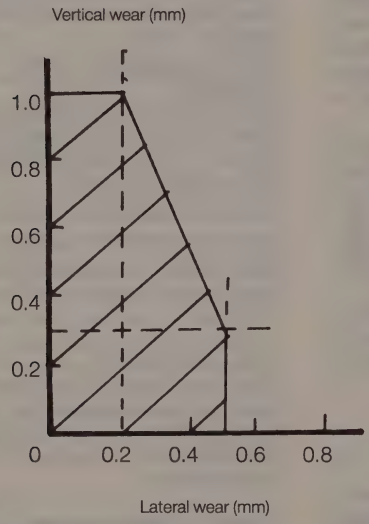


Fig. 2 Limits of allowable wear in endurance test

References

Other HMSO publications
Health Technical Memoranda
58 Internal doorsets

Other DHSS data
Activity data base
Ergonomic data
Health building notes

Other Official Publications
DHSS Nucleus study No. 11 fire evacuation exercises
DOE PSA MOB – Statement of Requirements Hardware for Doorsets Current Programme.

Other Publications
Association of Builders Hardware Manufacturers – Code of Practice for hardware essential to the optimum performance of fire-resisting timber doorsets.

The Guild of Architectural Inromongers – Code of Practice No.1 – Architectural Ironmongery suitable for use on:
1. Fire-resisting self closing timber doors
2. Emergency exit doors.

British standard specifications

BS1210	Wood screws
BS1227	Builders' hardware for housing
BS3621	Specification for thief resistant locks
BS3827	Glossary of terms relating to builders hardware: Part 1: Locks Part 2: Latches Part 3: Catches Part 4: Door, drawer, cupboard and gate furniture.
BS4112	Performance requirements for hardware for domestic furniture.
BS4951	Builders' hardware: lock and latch furniture (doors)(under revision 1989).
BS5466	Saline droplets corrosion test
BS5725	Specification for panic bolts and panic latches mechanically operated by horizontal push bar.
BS5839	Part 3: Specification for automatic release mechanisms.
BS5872	Specification for locks and latches for doors in buildings. (Under review 1989)
BS5810	Code of practice for Access for the disabled to buildings.
BS6459	Part 1: Door closers Part 3: Floor springs (under preparation 1989)
BS7036	Provision and installation of safety devices for automatic power operated pedestrian door systems.
DD171	Performance requirements for doors.

BRE Publications
Building Research Establishment Information Paper IP 2/82
"Ergonomic requirements for windows and doors"
BRE Report – An investigation of fire door closer forces.

Trade Associations

The Association of Builders Hardware Manufacturers,
5 Greenfield Crescent, Edgbaston, Birmingham B15.

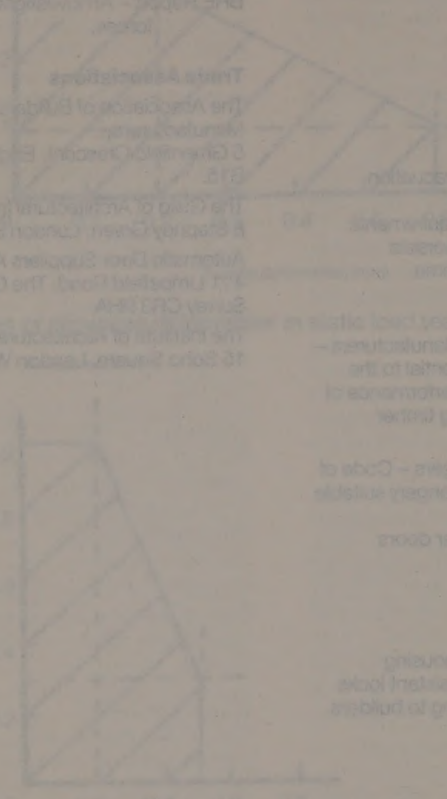
The Guild of Architectural Ironmongers,
8 Stepney Green, London E1 3JU

Automatic Door Suppliers Association,
411 Limpsfield Road, The Green, Warlingham, Surrey CR3 9HA

The Institute of Architectural Ironmongers,
15 Soho Square, London W1V 5FB

Index of Guidance Amendment No IGAN 18
(for internal use)
The following documents are cancelled by the contents of this document:
CDB 8.1 and 8.2

Printed in the United Kingdom for Her Majesty's Stationery Office
Dd290282 11/89 C40 G3390 10170



HMSO publications are available from:

HMSO Publications Centre
(Mail and telephone orders only)
PO Box 276, London, SW8 5DT
Telephone orders 01-873 9090
General enquiries 01-873 0011
(queuing system in operation for both numbers)

HMSO Bookshops
49 High Holborn, London, WC1V 6HB 01-873 0011 (Counter service only)
258 Broad Street, Birmingham, B1 2HE 021-643 3740
Southey House, 33 Wine Street, Bristol, BS1 2BQ (0272) 264306
9-21 Princess Street, Manchester, M60 8AS 061-834 7201
80 Chichester Street, Belfast, BT1 4JY (0232) 238451
71 Lothian Road, Edinburgh, EH3 9AZ 031-228 4181

HMSO's Accredited Agents
(see Yellow Pages)

and through good booksellers

£4.80 net

ISBN 0 11 321258 5